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ASPECTS OF NATURE IN THE AFRICAN SAHARA. A SUMMER JOURNEY.

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I.

IT was, I believe, Fromentin, the eminent French scholar and art critic, who remarked that the sudden view of the Orient through the gateway of El-Kantara presented the most contrasting picture of life and Nature that was to be found anywhere on the surface of the earth. How nearly true this statement may be it is hardly possible to determine, but it is certain that it would be difficult to find elsewhere on the globe a more striking closing of one world and opening of another. Through El-Kantara passes the solemn tread of the camel trains, whose destination is the silent Sahara and the deeper Soudan; in it are offered up the fervent Moslem prayers for a safe journey and return. The giant buttresses of the Atlas Mountains, red and purple with the glow of the morning and twilight sun, look down upon a tempestuous mountain torrent which has cut its way athwart their core, and grim and crag-eaten rocks, buried deep within their own bowlder masses, wall off with heights of three thousand to five thousand feet the gray and yellow panorama of shifting sands—the warm heart of the southern Sahara.

For years I had longed to see and feel this mysterious land—the land which had made forever famous the names of travelers who had sought to penetrate it—a land in which even to-day a "No trespass" is loudly written. Mungo Park, Denham, Clapperton, Barth, Nachtigal, and the lately deceased Gerhard Rohlfs, were heroes of my boyhood days, and now we were approaching the theater of their

exploits—not, however, in the manner of these pioneers, with a slowly pacing camel, but behind the energy of the iron horse. Let it not, however, be supposed that the passage of the locomotive through El-Kantara has revolutionized the desert; true, it has facili-

EL-KANTARA; THE GATEWAY TO THE DESERT.

tated entrance to it, and has secured a certain passageway farther into the interior. But the desert is still the desert of old; the skeletons of camels and mules lie scattered to the right and to the left—wrecks of vain effort to make the passage—the sands send back

to the sun the heat that they have received from the fiery luminary, and hordes of wandering Tuaregs, armed with gun and spear, still patrol the caravan ways that penetrate to the interior.

With all the wild, fitful, and forbidding Nature that belongs to the Sahara, it has also its elements of peace and good will. The cheer of a green oasis is, indeed, one of its first greetings, and long before the great flat expanse of sand is reached the traveler approaching from the north looks down upon an island of emerald verdure. The oasis of El-Kantara, the "first oasis" of the desert on the great caravan route leading to Lake Tchad, backs up its sea of palms to the very walls of the Great Atlas, and far into the gateway itself the feathered dates scatter themselves to meet the poplars from the north. How different, then, is this first view of the Sahara from that which the mind had pictured! It was late in the afternoon of an early September day, with the thermometer steadily rising from perhaps 92° to 98°, that we approached this land of true Africa. The bare and rugged rocks roll off from either side of us, to mingle with the almost endless wilderness of bowlders which cover the mountain foot, far off to the limits of vision. We pass caravans and parts of caravans, the swarthy children of the South contemplating our passage with at least the interest with which we drink in their picturesque garbs, the complacently meditating camels, the trains of yelping Arab curs, and children galore. How different the two modes of travel, and what feelings must the contrast inspire within the minds of these poor toilers of the desert sands!

A few days after our first approach to El-Kantara we returned to it for the purpose of better studying the character of this first oasis of the desert, and of entering into that delightful pursuit of searching for the evidences of past life in the neighborhood. We had been informed that fossils, mainly of a marine type, with beds of giant oysters, were to be found here, and, indeed, under the guidance of two Arabs who were well familiar with the region it did not take long to verify the statement that was made to us. The mountain slopes, especially where they had been furrowed into successive lines of depression and elevation, were teeming with the fossilized parts of an ancient fauna of the sea; sea urchins and oysters were particularly abundant, and their beautiful state of preservation added not a little to the delight of gathering specimens of their kind on the borders of a relentless desert.

To those who still conceive an oasis to be a gathering of a mere hundred or so of palm trees, protecting in its shade a basin of water that is hardly sufficient to quench the thirst of a few dismal-looking men and animals that may have straggled to it, the impression produced by the oasis of El-Kantara will be a pleasantly and re-

freshingly disappointing one. Seen from the lower slopes of the Atlas Mountains, or from the superb roadway which French engineering science has constructed on the line of the old Roman approach to the Sahara, the oasis stretches out a charming wil-

A Corner of the Oasis, Biskra.

derness of green, the closely matted tree tufts presenting so dense a canopy of verdure that the eye fails to penetrate to the soil that gives it birth. For the better part of a mile this sea of green extends virtually unbroken, throwing up a brilliance of monochrome coloring which it would be difficult to conceive equaled. Upward of eighty thousand date palms are the main adornment of this patch of green, but let it not be supposed that they alone constitute the vegetation of the oasis. Following in the path of our guide, Ben-Labri, one of the Arab residents of the little adobe village of El-Kantara situated on the outside, we entered the wilderness of green by a tortuous, narrow passageway leading between the mud houses, and found ourselves in a garden lane of striking and refreshing beauty. The fact is that the apparently unbroken oasis is in reality a number of distinct garden areas, belonging individually to separate families of the village, each one walled off by its casing of stone or adobe, much in the manner of field properties of more civilized regions. Between these walls run the numerous dividing lanes, buried in that dark shade which elsewhere would hardly be possible except in a primeval forest. Tumbling brooks and water courses, most of the latter of artificial conduct, follow the lines of these lanes, or course over the separating gardens, giving to the numerous basins which have here and there been cut around the clumps of palms their needed quantity of water. What perhaps surprised us more than anything else in the construction of the oasis was the large number of trees and bushes other than those of a desert aspect which formed a part of the vegetation. Orange and lemon trees, figs, pomegranates, peaches, and dwarf apples were well mixed in with the palms, besides a multitude of other plants, of which our limited botanical knowledge could hardly determine the natural order. The carob, with its long, pendent pods, and the prickly pear or nopal, the distinctive cactus of northern Africa, were conspicuously noticeable by their abundance. Here and there the trailing vine hung its luscious fruit, although not with that richness and vigor which characterize the grape growth of North America generally; also an occasional dandelion brought memories to us of our own fields and meadows, an association in no way lessened through the presence of clumps of raspberry and blackberry.

Comparatively few of the date palms carry their shafts to a height exceeding fifty or sixty feet, the greater number of them probably not rising higher than twenty-five to thirty feet. They were heavily laden with brown or yellow fruit, which, of course, constitutes one of the staple articles of food to the native. We found them much too sweet for our taste, and while the fruit was always attainable, the bunches frequently hanging down to within a

few feet of the ground, we rarely availed ourselves of our opportunity. The system of irrigation that is here carried on is so perfect that, despite the excessive heat of the summer season and the three months of dry heat that had already passed, we were scarcely able to discover a dry leaf or shoot among the hundreds of thousands by which we were surrounded. This was indeed a most extraordinary aspect, and one that specially appealed to the eye looking down from a mountain elevation.

A cluster of mud or adobe houses, whose one-storied rooms lie beneath the impending leaves of the palm, constitute the Arab village to the inhabitants of which is apportioned the proprietorship of the oasis. The Arabs here are naturally not nomads, but permanent fixtures, to whom a life in the desert has little of that Africa associated with it which is the proper service of the Arab of the caravan. Under the guidance of Ben-Labri we visited a number of the houses, most of which were constituted of two or three almost entirely vacant rooms, capped by thatchings of palm leaves. In some instances a semblance of a second story was presented by a projecting veranda, on which was pitched a round tent. What little of woodwork was necessary for the support of the walls or the roof, or to outline doorways and windows, was mainly constructed from the shaft of the palm, but a rather incongruous piece of architecture occasionally carried the eye to bits or entire frames of Venetian blinds. A somewhat rarer element of construction was to be found in blocks of ancient Roman masonry, whose fanciful carvings at one time graced much more imposing structures of the desert. It must be admitted that the first inspection of the hard earth flooring of the houses, with visions of scorpions and centipeds coursing over it in wild affray, or of a lurking horned viper eagerly scanning the path of each intruder, was not immediately conducive to a real desire to share its space; but a few moments' careful study of corners and under-spaces, which brought out only wandering humpbacked ants, soon dispelled the first feeling of uncanniness which a conceived danger inspires, and with the assistance of a large mat we were soon placed at ease and comparative comfort. We visited one of the schools, where the teacher as in days of old was inculcating the doctrines of the Koran to some twelve or fifteen little barefooted urchins, and also went through the village mosque. Judiciously taking the border of the room, or in the center avoiding the holy carpet, we were allowed to enter far enough to gratify a photographer's passion, and in a few minutes' time the drop-shutter announced several pictures taken.

Surprising as from many points of view was this oasis of El-Kantara, it only cleared the way for a still greater surprise when we reached Biskra, the present terminus of the Constantine-Saharan

THE CARAVAN ROUTE TO LAKE TCHAD PASSING THROUGH BISKRA.

Railway. Biskra has not inappropriately been termed "The Pearl of the Sahara," for in truth it combines much that would tend to make almost any place attractive. Its oasis extends over a linear expanse of nearly five miles, and in its area is crowded a forest of upward of a quarter of a million of date palms, in whose shade a multitude of trees and plants of the European flora find a congenial home. Biskra also has its true gardens, which have grown up under French rule and domination, and in some of these the rustic chair and table are by no means an unpleasant association. If the truth has to be told, the heart of Biskra might just as well be a town in the interior of France as part of an African oasis. One can not, to be sure, overlook the large number of Arabs and Ethiopians who congregate everywhere in troops or marching lines, or lounge in indifferent attitudes before their not wholly lordly manors—some shouting, some bargaining, and all, with the exception of the women, practically indifferent to the presence of the stranger; but with these products of the African soil rise up the outliers of European civilization—the hotels, the *cafés*, and a number of by no means unstately mansions which constitute the home of the foreign contingent of the population. The Hôtels du Sahara, de l'Oasis, and Victoria would do credit to far more important places than this, and while, perhaps, the accommodations and comforts served by them have in a measure been Africanized, they yet provide to the traveler all that is needed by way of relaxation and sustenance.

We put up at the Hôtel du Sahara, where we found a charming hostess in the person of Madame Chabert. Under the amiable method of this lady, supported by the *plaisir* of her two daughters, we were not long in reaching the conclusion that even a summer day in the African desert can not only be made bearable but decidedly enjoyable. Our arrival in the evening did not permit us to clearly make out the exact nature of our surroundings, but sufficient was visible to indicate that in our entertainment we should be obliged to conform in part to entirely new and interesting situations. The dining room was constituted by the tunnel which opened into the street in front and the court in the rear, and its continuation was the open air-space beyond. Our part of the meal was served under the waving tufts of the date palm overhead, and it was a no mean luxury to be fed in good, old-fashioned French style in this *al fresco* corner of the garden. The thermometer at this time, about eight o'clock, covered the better part of its range of 100°, and thus, while still sufficiently high, it had already lost about sixteen degrees of its column. A steaming heat this, but nevertheless, and despite the fatigue of the day's journey, it did not feel particularly oppressive. The two delicacies that were served to us were the grape of

BOUND FOR THE SOUDAN—CROSSING THE OUTAIA.

North Africa—than which a more luscious fruit can hardly be found anywhere, not even on the volcanic slopes of the famous Hegyalya of Hungary—and ice. Unfortunately, health considerations required (or, at least, we thought that they so required) that the last-named article should be associated with some vinous or mineral water, and we therefore could not indulge in what would have been at the time one of the greatest of luxuries—ice-water.

Still early in the evening the pattering of raindrops taught us that the Sahara was even in the most heated and driest portion of the year not entirely rainless—a correction to geographical statements of a kind of which we had many to make during our African experiences. The rain was of not long duration, nor of more than feeble quality, but before it ceased it was accompanied by hail and a vivid showing of lightning in the western sky.

The sleeping apartments of this interesting hotel opened on stone corridors either in the front or in the rear; the spacious doorways, which in most cases took the place of both doorway and window, permitted of a generous exchange of inside and outside air, but it can not be said that there was enough of this to produce a really cooling effect. Even sprinkling the stone flooring of the rooms produced hardly more than a momentary relief against the pressure of a somewhat suffocating atmosphere; yet, with all, we managed to pass a sufficiently comfortable night, and one that surely was not lacking in interest as the first night in an African oasis.

Biskra lies thirty-three miles beyond El-Kantara, and therefore about this distance within the Sahara itself. To it outliers of the Great Atlas still descend, but beyond its final palm begins that almost endless expanse of gravel and sand—gently moving here into dunes and sand hills, elsewhere covering with a thin crust the underlying rock of the region—which constitutes the sandy Sahara. From any eminence in the town the eye wanders far into the wilderness of this lonely expanse—flat as the surface of the sea, more silent than the melancholy waste of the deep ocean. Biskra is elevated but three hundred and sixty feet above the sea, and from it the land gently falls away until, at the great Schott Melghigh, it is carried down seventy feet or more below the actual ocean level. It lies on the caravan route to Tuggart, Ouargla, and the central Soudan, the route which as late as 1881 saw the annihilation of the Government expedition of Flatters, and passes but little to one side of the territory of Ghadames, where was enacted the tragedy of the past year—the extermination of the exploring column of Count Moras.

It can hardly be said that Biskra is as yet what has been claimed for it, a truly charming wintering resort. If climate alone can make a place charming, it probably is such, as, apart from sand storms and

other meteorological phenomena which pertain more properly to the land surface than to the air, the winter climate of this spot is probably all that need be desired; but the oasis, and with it the town, lacks those attributes of pleasurable comfort which are needed to sustain and insure periodic change to the resting body. The kaleidoscopic sublimity of the Atlas Mountains, receiving that indescribable glow of coloring which even the painter's hand can hardly touch, entrances by its polychrome effect; the passing caravans are an interest for some days or perhaps even weeks; but the utter

THE LEADER OF A CARAVAN.

sameness of the desert beyond, its vast monotonous solitudes of resting or driving sands, begins to pall upon the mind, which seeks for change, for some relief whether of climate, life, or scene, but finds it not. It is true that in their customary way as colonizers and as seekers of the humble pleasures, the French are striving to make tenable those amusements which are a part of the habit and life of the mother country; the polo field, tennis court, and racecourse are all here, but they are not sufficient to wear away the wearisome sameness of Biskra life. Even the clamor or glamour of an Arab or Ethiopian market, especially where the

rates of sale are seemingly inordinately high, is incapable of dispelling the feeling of desert loneliness that pervades both mind and body; nor yet more conducive to hilarity is the daily visit of the "pet of the desert," the name given to a somewhat aged and feeble lion, once a monarch of the surrounding sands, which, attended or unattended, saunters about the open squares and roadways, neither disturbing the peace of the community nor in any way disturbed by it. Aged women pet it, little children fondle it, but the great mane no longer rises in wrath, nor does the bushy tail lash the body in the fury of excitement. Impending darkness has settled upon the eyes of the once noble animal, and before long it will be only a chain and scent that will direct its course. The lion was not in Biskra at the time of our visit, and we thus missed the town's most interesting inhabitant.

We remained only a few days in Biskra, but in that time sufficiently familiarized ourselves with the locality to know its most distinctive and special features. Even during the greatest heat of the day it was hardly inconvenient to follow the long lines of roadway; and where these passed within the shade of overhanging palms, or alongside the cool meandering waters of natural streams or artesian wells, there was little in the temperature to suggest that we were sightseeing in presumably very nearly the hottest part of the earth's surface and in its hottest season. During nearly all hours of the day caravans or parts of caravans file out on the long central avenue which leads through the oasis and continues across the open sand flats that follow upon the last palm. This is the great caravan route to the region of Lake Tchad. Near the southern end of the town is the Ethiopian village where one sees the life of the true African, though not the true negro—the people whom we associate with the dynasties of Egypt and Nubia, the people who constituted the followers of Cleopatra, and who probably were in the line of parentage of Cleopatra herself. It is here, as well as in the oases farther south, that one sees the stately nut-brown women who figure in the characteristic scenes of ancient Africa, their loose draperies of dark blue, their pendants of gold still hanging and glittering as in days of old. Their high earthen water pots, borne erect on the head or shoulder, still go to the well as they did thousands of years ago, and the litle infant continues to cling to the mother's back, suspended in the folds of the parent's tunic.

We found these people, especially the younger women, exceedingly shy, and hardly any amount of coaxing could induce them to stand for a photograph. Sitting in front of their mud houses, rolling out corn or some manufacture from corn flour, they would rise the moment they obtained a glimpse of the camera box, and not even

Bedouin Encampment in the Sahara. Atlas Mountains in the Distance.

a free exhibition of coppers would return to the places those whom we had disturbed. We fared better with the older women, partly because they objected less to the privileges we were assuming for ourselves, and partly (perhaps it can be said mainly) because their slower movements gave us the opportunity to make a result with the instantaneous shutter.

A corner, or rather street, of Biskra which has its special attraction for the as yet rather limited number of strangers who have discovered in the oasis a true climatic resort is the Ouled-el-Nail, or "street of the dancing girls," as it is most generally known. Here congregate the Arab women, young and old, of the tribe of Nail, whose graces and *abandon* have earned for them a special reputation throughout the land. They are the "select of the select," but just why they should be considered so will probably not be apparent to most strangers. Feminine Arab beauty, despite what poets and some few travelers may have said or written about it, is not an unmitigated joy to the eye, nor that dream of loveliness toward which the artist has swung his minstrel harp. By the average European or American the Arab woman would be rated homely, if nothing more; the redeeming features of her face are the lustrous and truly exquisite eyes and the veil which hides the remaining features of her visage. Among the women of the Nail tribe, at least among those whom we had the opportunity to meet, sitting on the street curbs, lounging in the doorways, or going through their Terpsichorean antics in the coffeehouses, there was hardly a respectable feature to be seen, the worn and haggard countenances and deeply furrowed lines plainly reading the histories of their debauched lives; add to this in most cases an ungainly or warped figure, clothed in a most bizarre attire of brilliant coloring, and elaborately assisted by a veritable storehouse of jewels and gold and silver ornaments, and we have the general make-up of these nymphs of the desert. The quantity of precious plate and chains that is worn by the women is truly astonishing, the decoration of the person, manifestly, being limited only by the quantity of material that may be had to put on. We visited one of the coffeehouses where a portion of the evening was, on demand, given over to dancing, but we found the movements and the whole proceedings so slow and tiresome that we left almost immediately after we had disposed of our coffee. The coffeehouse is itself—as, indeed, we found most of the native coffeehouses of the country—a model of good order, wholly relieved of riotous manner, and the very embodiment of ease and cleanliness. We enjoyed the privilege of seats, but the greater number of those present were squatted directly upon the stone or brick flooring, or upon a mat or rug that was pulled over it. Rich and poor frequent these

houses alike, and in them are usually treated to music of a not absolutely inferior quality. To say that good coffee is to be had at the native coffeehouses is stating a truism, and a condition which probably few will venture to deny. Coffee is the soul of the land, and its history a part of the history of the people themselves.

THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(*Lowell Institute Lectures, 1896.*)

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XIV.—URBAN PROBLEMS.

THE extreme fluidity of our heterogeneous population is impressed upon us by every phenomenon of social life here in America. We imagine the people of Europe, on the other hand, after scores of generations of stable habitation, to have settled themselves permanently and contentedly into place. This is an entirely erroneous assumption. As a matter of fact, they are almost as mobile as our own American types. There are two ways in which demographic crystallization may have taken place. A people may have become rigid horizontally, divided into castes, or social strata; or it may be geographically segregated into localized communities, varying in size all the way from the isolated hamlet to the highly individualized nation. Both of these forms of crystallization are breaking down to-day under the pressure of modern industrialism and democracy, in Europe as well as in America. Nor is it true that the recency of our American social life has made the phenomena of change more marked here than abroad. In fact, with the relics of the old *régime* on every hand, the present tendencies in Europe are the more startling of the two by reason of the immediate contrast. Demographic processes are at work which promise mighty results for the future. These are not cataclysmic, like the French Revolution; but being well-nigh universal, the fact that they are slow-moving should not blind us to their ultimate effects. Such movements threaten to break up, not only the horizontal social stratification, but the vertical geographical cleavage of locality and nationality as well. Obviously any disturbance of these at once involves destruction of the racial individuality of the continent at the same time. For this reason, many phases of social analysis appertain

directly to the sphere of natural science. The anthropologist and sociologist alike are called upon to take cognizance of the same phenomena. The physical and social sciences are equally involved in the determination of their laws. Certain problems of city life are foremost among these questions, which lie on the border line between what were once widely separate sciences.*

The most conservative societies in Europe are really to-day a seething mass of moving particles, viewed with the statistical eye. To borrow a familiar figure, a great population almost anywhere is like the atmosphere; even when apparently most quiescent, in the sunlight of investigation, revealing itself surcharged with myriad motes in ceaseless agitation. These particles, microscopic or human, as the case may be, are swept along in currents, determined both in their direction and intensity by definite causes. With men, the impelling forces are reducible mainly to economic and social factors. Most powerful of these movements of population to-day is the constant trend from the rural districts to the city. Its origin is perfectly apparent. Economically it is induced by the advantages of co-operation in labor; perhaps it would be nearer the truth to say, by the necessity of aggregation imposed by nineteenth-century industrialism. This economic incentive to migration to the towns is strengthened by the social advantages of urban life, the attractions of the crowd; often potent enough in themselves, as we know, to hold people to the tenement despite the opportunity for advancement, expansion, or superior comfort afforded elsewhere outside the city walls. The effect of these two combined motives, the economic plus the social, is to produce a steady drift of population toward the towns. This has a double significance. It promises to dissolve the bonds of geographical individuality—nay, even of nationality; for a political frontier is no bar against such immigration, provided the incentive be keen enough. At the same time it opens the way for an upheaval of the horizontal or social stratification of population; since in the city, advancement or degradation in the scale of living is alike possible, as nowhere else in the quiet life of the country.

The sudden growth of great cities is the first result of the phenomenon of immigration which we have to note. We think of this as essentially an American problem. We comfort ourselves in our failures of municipal administration with that thought. This is a grievous deception. Most of the European cities have increased in population more rapidly than in America. Shaw has emphasized

* All footnote references in this article run to a Bibliography of the Anthropology and Ethnology of Europe to be published by the Boston Public Library. Full titles of all papers will be found under the proper authors and dates in that list.

the same fact in his brilliant work on Municipal Government in Europe. This is particularly true of great German urban centers.* Berlin has outgrown our own metropolis, New York, in less than a generation, having in twenty-five years added as many actual new residents as Chicago, and twice as many as Philadelphia. Hamburg has gained twice as many in population since 1875 as Boston; Leipsic has distanced St. Louis. The same demographic outburst has occurred in the smaller German cities as well. Cologne has gained the lead over Cleveland, Buffalo, and Pittsburg, although in 1880 it was the smallest of the four. Magdeburg has grown faster than Providence in the last ten years. Düsseldorf has likewise outgrown St. Paul. Beyond the confines of the German Empire, from Norway to Italy, the same is true. Stockholm has doubled its population; Copenhagen has increased two and one half times; Christiania has trebled its numbers in a generation. Rome has increased from 184,000 in 1860 to 450,000 in 1894. Vienna, including its suburbs, has grown three times over within the same period. Paris from 1881 to 1891 absorbed four fifths of the total increase of population for all of France within the same period.

Contemporancously with this marvelous growth of urban centers, we observe a progressive depopulation of the rural districts. What is going on in our New England States, especially in Massachusetts, is entirely characteristic of large areas in Europe. Take France, for example. Most of us are aware of the distressing demographic condition of affairs in that country. One of the finest populations in Europe is almost at a standstill numerically; nay, some years show an actual decrease of population. This is not due to emigration abroad, for the French are notably backward in this respect. Nor can it be ascribed to a heavy mortality. The death rate has appreciably fallen during this century, in conformity with the great advances made in hygiene and sanitation. The marriage rate is lower than usual. Yet for some reason children do not come to cheer the land. The practical result is that Germany, the great political rival, seems destined to control the European military situation in future.† Such is the condition, viewing the country as a whole. Studying it in detail, the evil is still more magnified; for, with a stationary population for the entire country, the cities continue to grow, draining the life blood of the rural districts year by year, with ever-increasing vigor. The towns are absorbing even

* N. Brückner. Die Entwickelung der grossstädtischen Bevölkerung im Gebiete des deutschen Reichs. Allgemeines statistisches Archiv, Tübingen, i, 1890, pp. 135–184.

† We have analyzed certain of these details in French demography in Publications of the American Statistical Association, iii, 1892, pp. 248 *et seq.*

more than the natural increment of country population; they are drawing off the middle-aged as well as the young. Thus great areas are being actually depopulated. For example, in the decade from 1881 to 1891, the French cities of 30,000 inhabitants or over added to their respective numbers more than three times as many as the total increase of population for the entire country. Even their due proportion of the abnormally slow increase was denied to the rural districts; the ten years left them less densely populated than before. In 1846 almost half of the eighty-eight departments in France had a larger population than they have to-day. Paris alone, the metropolis, has, as we have already observed, absorbed four fifths of the entire increase of the land; the remainder was added to the other large cities in proportion to their size. The British Isles exemplify the same tendency. More than half of the English towns with populations over 25,000 are the product of this century. Sixty out of one hundred and five of these cities have arisen since 1825. This is, of course, due to the extension of the factory system in great measure. The same depopulation of the rural districts is noted. Ten rural counties in England and Wales alone have fewer inhabitants than in 1851. The fact is that western Europe is being gradually transformed into a huge factory town. It is being fed less and less from the products of its own territory. The wheat fields of the Americas, India, and Australia are contributing what formerly was raised by the peasantry at home. It is not surprising that the trend is toward the cities; were it even more marked it would be no marvel.

This growth of city populations has, then, taken place largely at the expense of the country. It must be so, for the urban birth rates are not enough in excess of the mortality, save in a few cases, to account for more than a small part of the wonderful growth which we have instanced. The towns are being constantly recruited from without. Nor is it an indiscriminate flocking cityward which is taking place. A process of selection is at work on a grand scale. The great majority to-day who are pouring into the cities are those who, like the emigrants to the United States in the old days of natural migration, come because they have the physical equipment and the mental disposition to seek a betterment of their fortunes away from home. Of course, an appreciable contingent of such migrant types is composed of the merely discontented, of the restless, and the adventurous; but in the main the best blood of the land it is which feeds into the arteries of city life.

Another more certain mode of proof is possible for demonstrating that the population of cities is largely made up either of direct

immigrants from the country or of their immediate descendants. Dr. Ammon, of Carlsruhe, in a most suggestive work which we have constantly cited in these pages,* has carefully analyzed in detail the populations of certain representative cities in Baden. In Carlsruhe and Freiburg, for example, he found that among the conscripts examined for military service an overwhelming proportion of the residents were either immigrants themselves or else the children of immigrants. Less than eight per cent, in fact, were the children of city-born parents—that is to say, were the outcome of three generations of continued urban residence. In a similar investigation of other German cities, Hansen found that nearly one half their residents were of direct country descent. In London it has been shown that over one third of its population are immigrants; and in Paris the same is true. For thirty of the principal cities of Europe it has been calculated that only about one fifth of their increase is from the loins of their own people, the overwhelming majority being of country birth. One direct result of this state of affairs is that cities as a rule contain more than their due proportion of middle-aged adults. They do not immigrate until they have attained majority; they do not marry till comparatively late in life, so that children and young persons form an unusually small percentage of the entire population. The aged, moreover, often betake themselves to the country after the stress of life is abated. They return to their place of birth, there to spend the last days in peace. These latter, together with those who are driven back to their homes by the fierce competitions of city life, constitute a certain feeble counter current of migration from the city outward. Yet this is insignificant compared with the inflowing tide. Thousands are yearly pouring into the towns, while those who emerge may be numbered by hundreds, perhaps even by scores. The fact is that the great majority of these immigrants either fall by the way: or else their line, lacking vitality, dwindling in numbers either through late marriages and few children, or else the opposite extreme of overproduction and abnormal mortality, comes to naught in a few generations. Thus the steady influx of immigration goes on. Truly, cities are, as has been observed, "consumers of population." Our problem here is to determine whether such consumption is being applied equally to all our racial types; if not, the future of Europe, ethnically, can not but be profoundly affected. The future character of European peoples will be largely determined by this circumstance. From the point of view of relative increase, the German nation is undoubtedly in the lead, especially as compared with the

* Die natürliche Auslese beim Menschen. Jena, 1893.

French. Equally important, however, is it to consider the relative destruction which is annually being waged. If, as is asserted, these prolific Teutons are pre-eminently a city type, and if thereby they lay themselves open to decimation, the future balance of power in Europe may not be so completely disturbed after all.

These various social phenomena have been most ably correlated in a rather suggestive broad-line sketch of a mode of social selection given by Hansen.* Basing his hypothesis upon data derived in the main from the cities of Germany, he distinguishes in any given population what he designates as three degrees of vital and psychic capacity respectively. The vitality is measured in each class by the ratio of the birth to the death-rate. The first vitality rank consists of the well-to-do country people, leading a tranquil existence, healthy in mind and body, free alike from dread or aspiration. This class increases rapidly by birth, and loses relatively few by premature mortality. It has enough and to spare in numbers. Both country and city alike depend upon it for future growth. Below this is a second vitality rank, composed of the middle classes in the towns. Herein we find a somewhat lower birth rate; ambition and possibility of social advancement become effective in limiting the size of families. Coincident with this is a low death rate, owing to material comfort and a goodly intelligence. This class holds its own in numbers, perhaps contributes slightly to swell the census returns from year to year. Below this lies the third vitality rank, composed of the great mass of the urban populations, the unskilled labor and the poorer artisans. Here occur an abnormally high birth rate, little self-restraint, and, through ignorance and poverty, an inordinately high rate of mortality. This is the portion of the city population continually recruited from the country or through rejects from the superior classes—those, that is to say, who fail in the intense competition of the upper grades of society. Measured by vitality alone, it would appear that the first rank we have described—the average country population—were the ideal one. Applying, however, the tests of intellectual capacity, Hansen discovers curious cross-cleavages. For the country population is being continually drained of its best blood; those who are energetic or ambitious in the majority of cases leaving their homes to seek success in the city. Thus an intellectual residuum is left on the soil, representing merely the average intelligence; perhaps, if near a great metropolis, even falling below the normal in this respect. Those in their turn who emigrate to the towns are speedily sorted by inexorable fate. Some achieve success; the majority perhaps go

* Die drei Bevölkerungsstufen. München, 1889.

to swell the other middle classes; or else, entirely worsted in the struggle, land in a generation or two in the lowest ranks of all. Thus a continual tide of migration becomes necessary to insure stability in numbers in the entire population. This ingenious scheme, too simple of course to be entirely correct, as Giddings has suggestively pointed out,* does nevertheless contain a germ of truth. Our problem is to test its applicability to modern conditions by a study of purely anthropological facts.

The first physical characteristic of urban populations, as compared with those of country districts, which we have to note, is their tendency toward that elongated shape of head which is characteristic of two of our principal racial types, the Teutonic and the Mediterranean respectively.

It seems as if for some reason the broad-headed Alpine race was distinctly a rural type. This we might have expected from the persistency with which it clings, as we have seen, all over Europe, to the mountainous or otherwise isolated areas. Thirty years ago an observer in the ethnically Alpine district of south central France noted an appreciable difference between town and country in the head form of the people.† In a half dozen of the smaller cities his observations pointed to a greater prevalence of the long-headed type than in the country round about. In the same year, in the city of Modena in Italy, investigations of the town and country populations, instituted for entirely different purposes, brought the same peculiarity to light.‡ These facts escaped notice, however, for about a quarter of a century. In entire ignorance of them, in 1889, a gifted young professor in the university at Montpellier in southern France, having for some years been occupied in outlining various theories of social selection, stumbled upon a surprising natural phenomenon.* On examination of a considerable series of skulls, dating from various periods in the last two hundred years, which had been preserved in crypts at Montpellier, he found that the upper classes, as compared with the plebeian population, contained a much larger percentage of long-headed crania. These crania of the aristocracy, in other words, seemed to conform much more nearly to the head form of the Teutonic race than those of the common people. Additional interest was awakened in the following year by the researches of Dr. Ammon, of Carlsruhe, who, working again in entire independence upon measurements of thousands of conscripts of the Grand Duchy of Baden, discovered radical differences

* Principles of Sociology, pp. 342 *et seq.*

† Durand de Gros, 1868 a, p. 228, 1868 b, and 1869.

‡ Calori, 1868; Lombroso, 1878, p. 123; Ricardi, 1883; and Livi, 1886, p. 274, have since confirmed it.

* Lapouge, 1889 b.

here between the head form in city and country, and between the upper and lower classes in the larger towns.* Several explanations for this were possible. The direct influence of urban life might conceivably have brought it about, acting through superior education, habits of life, and the like. There was no psychological basis for this assumption. Another tenable hypothesis was that in these cities, situated, as we have endeavored to show, in a land where two racial types of population were existing side by side, the city for some reason exerted superior powers of attraction upon the long-headed race. If this were true, then, by a combined process of social and racial selection, Carlsruhe, Freiburg, Mannheim, and the other towns would be continually drawing unto themselves that tall and blond Teutonic type of population which, as history teaches us, has dominated social and political affairs in Europe for centuries. This suggested itself as the probable solution of the question; and investigations all over Europe during the last five years have been directed to the further analysis of the matter. This was not an entirely new discovery even for Germany; the same fact had been previously noted in Würtemberg, that the peasantry were noticeably rounder-headed than the upper classes.† Yet Ammon undoubtedly first gave detailed proof of its existence, basing it upon a great number of physical measurements; and he undoubtedly first recognized its profound significance for the future. To him belongs the honor of the discovery of the so-called "Ammon's law," that the Teutonic race betrays almost everywhere a marked *penchant* for city life. This is all the more surprising as Tacitus tells us that the ancient Germans, unlike the Italians, were strongly imbued with a hatred of communal existence. We have no time to give in detail all the evidence which has been accumulated in favor of its validity. The fact of greater frequency of the long-headed type in town populations, as compared with rural districts, has been established by Lapouge in a great number of investigations all through central and southern France ‡ and in Brittany.* Collignon, foremost authority upon the physical anthropology of France, gives in his adherence to it as a general rule, finding it applicable to Bordeaux and nearly all the cities of the southwest.‖ It seems to hold true in Vienna, which with its suburbs forms a little islet of Teutonic long-headedness in Austria.△ In northern Italy the long-headedness is quite universally more prevalent in all

* Ammon, 1890; and 1893, p. 72. † Von Hölder, 1876, p. 15.

‡ Lapouge, 1894, p. 483; 1896 a, p. 401; 1897. Closson has presented his work most acceptably to English readers. * Lapouge, 1896 b, p. 91; also, Muffang, 1897.

‖ 1895, pp. 123–125; see also table in 1894 b, p. 19, on Limoges.

△ Weisbach, 1895 b, p. 77, map.

the cities, although the opposite is more often true south of Rome.* It is true of Paris and Lyons especially, the department of the Seine being well below the average for France and for the neighboring departments.† In Spain the only indication of the law is offered by Madrid, where nearly seven hundred conscripts have been measured in detail.‡ In this latter country, as in the British Isles,* and in southern Italy, as we have observed, everywhere in fact on the outskirts of Europe where the Alpine broad-headed race is but sparsely represented, we find the contrasts in head form between city and country absent in great measure. Observations on four hundred and eighty-seven American college students have not yielded me any differences in this respect. Only where the Alpine race forms an appreciable element in the population does "Ammon's law" appear to hold true.

The circumstance which we have mentioned, that only in those portions of Europe where the Alpine broad-headed type is strongly in evidence do we find a more prevalent long-headedness in the city populations, suggests a criticism upon the somewhat extravagant claims to the universality of "Ammon's law." made by ardent disciples of the school of so-called "anthropo-sociologists." It is this: City populations are the inevitable result of great intermixture of blood; they of necessity contain a hodge-podge of all the ethnic elements which lie within the territory tributary to them, which, in other words, lie within what Lapouge has aptly termed their "spheres of attraction." || As a whole, one should not expect to find the extreme individuality of type in the cities, which can persist alone in the isolated areas free from ethnic intermixture. If, as in Baden, in Brittany, or along the Rhône Valley, an extremely broad-headed type of population is localized in the mountains, as we know it is all over Europe; while along the rivers and on the seacoast are found many representatives of an immigrant Teutonic long-headed people; it would not be surprising that cities located on the border line of the two areas should contain a majority of human types intermediate between the two extremes on either side. These city populations would naturally be longer-headed than the pure Alpine race behind them in the mountains, and coincidently broader-headed than the pure Teutons along the rivers and on the seacoast. The experience of Italy is instructive. In this country the transition from a pure Alpine broad-headed population in the north to an equally pure and long-headed Mediterranean type in the south is

* Livi, 1896 a, pp. 87–89, 147, 148, 151, 159, and 187.
† Lapouge, 1897, p 70.
‡ Oloriz, 1894 b, pp. 47 and 279; also pp. 173 and 224.
* Beddoe, 1894, p. 664.
|| This point I have discussed at length, borrowing largely from Livi's superb work on Italy, in the Publications of the American Statistical Association, v, 1896, pp. 57 *et seq.*

perfectly regular, as our maps in the October (1897) number of this series have made manifest. It has been established that while the cities in the north are less broad-headed than the country, in mid-Italy no apprcciable difference between the two exists; and in the south, the cities being ever nearer the mean for the country as a whole, actually contain fewer long-headed individuals than the rural districts. This consideration, which no statistician can fail to keep in mind, seems, however, to be insufficient to account for thc entire phenomcnon, cspecially north of the Alps. We are forced to the conclusion, in other words, that there is some mental characteristic of the long-headed race or types, either their energy, ambition, or hardiness, which makes them peculiarly prone to migrate from the country to the city; or else, what would compass the same result, a peculiar disinclination on the part of the broad-hcaded Alpine race of central Europe thus to betake itself to the towns. The result in either case would be to leave the fate of the urban populations to be dctermined more and more by the long-headed type.

A second mode of proof of the peculiar tendency of the long-headed type to gravitate toward the city is based upon the dctailcd study of individuals, tracing each person from his place of birth, or from generation to generation from the rural origin to the final urban residence. Dr. Ammon divided his conscripts into three classes: The *urban*, those whose fathers were of city birth, as well as themselves; the *semi-urban*, comprising those born in cities, but whose fathers were immigrants from the country; and, thirdly, the *semi-rural* class, who, born in the country, had themselves taken up an abode in the city. Comparing these three classes with those who were still domiciled in the country, a regularly increasing long-headedness was apparent in each generation. Lapouge and his disciples in France are now collecting much valuable information upon this point which can not fail to be suggestive when accumulated in sufficient amount. Everything goes to prove a slight but quite general tendency toward this peculiar physical characteristic in the town populations, or in the migratory class, which has either the courage, the energy, or the physical ability to seek its fortunes at a distance from its rural birthplace.

Is this phenomenon, the segregation of a long-headed physical type in city populations, merely the manifestation of a restless tendency on the part of the Teutonic race to reassert itself in the new phases of nineteenth-century competition? All through history this type has been characteristic of the dominant classes, especially in military and political, perhaps rather than purely intellectual, affairs. All the leading dynasties of Europe have long been re-

cruited from its ranks. The contrast of this type, whose energy has carried it all over Europe, with the persistently sedentary Alpine race is very marked. A certain passivity, or patience, is characteristic of the Alpine peasantry. This is true all the way from northwestern Spain, where Tubino (1877) notes its degeneration into morosity in the peasantry, as far as Russia, where the great inert Slavic horde of northeastern Europe submits with abject resignation to the political despotism of the house of the Romanoffs. Ordinarily a negative factor in polities, always socially conservative, this race when once aroused becomes irresistible. As a rule, not characterized by the domineering spirit of the Teuton, this Alpine type makes a comfortable and contented neighbor, a resigned and peaceful subject. Whether this rather negative character of the Alpine race is entirely innate: or whether it is in part, like many of its social phenomena, merely a reflection from the almost invariably inhospitable habitat in which it has long been isolated, we may not pretend to decide.

The peculiar temperament of the Alpine population comes to the surface in political affairs, being attested by great conservatism. This reactionary instinct is in the long run far more common to all human nature, I believe, than is generally supposed; in the Alpine Celt it is developed or conserved, if you please, to a marked degree. Socially, the peculiarities of disposition we have mentioned are of even greater importance, as we sought to impress in our preceding article. In fact, the future of the type depends largely upon this circumstance. The most persistent attribute of the Alpine Celt is his extreme attachment to the soil, or, perhaps, better, to locality. He seems to be a sedentary type *par excellence;* he seldom migrates, except after great provocation; so that, once settled, he clings to his patrimony through all persecution, climatic or human. If he migrates to the cities, as does the "mobile" Teuton, he generally returns home to the country to spend his last days in peace. Such re-emigration of the Alpine type late in life is in fact offered by Collignon * as the main explanation for the prevalence of the long-headed variety in the towns to-day. He inclines to this view rather than to the theory that it is due to the greater number of the immigrant Teutons, as Ammon and Lapouge are disposed to maintain. At all events, whichever explanation be true, the fact that mental differences between our racial types exist, if they become accentuated with the ever-increasing pressure of civilization, can not but profoundly affect the future complexion of European populations. A phase of racial or social competition of such

* 1895, p. 125.

magnitude that we hesitate to predict its possible effects, is at once suggested.

Let us now for a moment take up the consideration of a second physical characteristic of city populations—viz., stature. Some interesting points are concerned herein. The apparently contradictory testimony in this respect becomes in itself highly suggestive, I think, for the student of social problems. A few of the older observers found that city populations sometimes surpassed those of the country in the average of bodily height. Thus Quetelet * and Villermé (1829) discovered such a superiority of stature in the Belgian cities, amounting to several centimetres. From this coincidence Quetelet derived a law to the effect that the superior advantages of urban residence were directly reflected in the physical development of the people. This hypothesis is now definitely disproved by all the data available. If there be a law at all in respect of average statures, it demonstrates rather the depressing effects of city life than the reverse. For example, Hamburg is far below the average for Germany;† Dunant (1867) finds it true in Geneva; Pagliani observed it in Turin. The city of Madrid contains almost the shortest male population in all Spain; only one province, Valladolid, standing slightly below it. Residents of its poorer quarters are absolutely the shortest in the entire peninsula.‡ All over Britain there are indications of the same law, that town populations are on the average comparatively short of stature. The townsmen of Glasgow and Edinburgh are four inches or more shorter than the country folk roundabout, and thirty-six pounds on the average lighter in weight.* Dr. Beddoe, the great authority upon this subject, concludes his investigation of the population of Great Britain thus: "It may therefore be taken as *proved* that the stature of men in the large towns of Britain is lowered considerably below the standard of the nation, and as *probable* that such degradation is hereditary and progressive.|| Not all authorities are able to find such differences, especially in the less industrially developed portions of Europe; as in Hungary, where Scheiber ^ could detect no variation between city and country at all. Ammon, in Baden, alone among modern observers, finds a higher average stature in the cities. He ascribes it to greater frequency of the tall Teutonic type.◊ Nevertheless, the trend of testimony is in favor of Beddoe's view, as a rule; especially when applied to the great modern factory towns,

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* 1869, p. 33.

† Meisner, 1889, p. 116. Reischel, 1889, pp. 139–142, notes it of smaller cities, as in Erfurt.

‡ Olóriz, 1896, pp. 42 and 60.

* British Association, Anthropometric Committee Report, 1883, pp. 273 *circa*.

|| 1867, p. 180. ^ 1881, p. 254. ◊ 1893, p. 116.

where contributory influences, such as professional selection and the like, come into operation.*

A most important point in this connection is the great variability of city populations in size. All observers comment upon this. It is of profound significance. The people of the west and east ends in each city differ widely. The population of the aristocratic quarters is often found to exceed in stature the people of the tenement districts. Manouvrier (1888) has analyzed the Parisians most suggestively in this respect, giving a map to show his results. In Madrid also it appears that the well-to-do people are nearly two inches taller on the average than the residents of the poorer quarters.† We should expect this, of course, as a direct result of the depressing influence of unfavorable environment. Yet there is apparently another factor underlying that—viz., social selection. While cities contain so large a proportion of degenerate physical types as on the average to fall below the surrounding country in stature, nevertheless they also are found to include an inordinately large number of very tall and well-developed individuals. In other words, compared with the rural districts where all men are subject to the same conditions of life, we discover in the city that the population has differentiated into the very tall and the very short. This is true in Hamburg; ‡ it holds good in many of the cities of Switzerland, especially in Basle,* where it has been found that the percentage of tall men, over five feet seven inches in height, is nearly twice that in the country roundabout. At the same time the stunted individuals are in the same city two and a half times as frequent as outside the city walls. In Modena a similar frequency of very tall men has been noted.‖ The explanation is simple. The tall men are in the main those vigorous, mettlesome, presumably healthy individuals, who have themselves, or in the person of their fathers, come to the city in search of the prizes which urban life has to offer to the successful. On the other hand, the degenerate, the stunted, those who entirely outnumber the others, so far as to drag the average for the city as a whole below the normal, are the grist turned out by the city mill. They are the product of the tenement, the sweat shop, vice, and crime. Of course, normally developed men, as ever, constitute the main bulk of the population; but these two widely divergent classes attain a very considerable representation. As an example of the influence of such selection, Dr. Beddoe remarks upon the noticeably short stature of all the

* These we have heretofore analyzed in our article on Stature in the May (1897) number of this present series.

† Olóriz, 1896, pp. 42 and 61.

‡ Meisner, 1889, p. 120.

* Chalumeau, 1896 a, p. 7.

‖ Riccardi, 1882, pp. 249–253.

agricultural counties about London, being even less than in the metropolis itself.* On the other hand, the Anthropometric Committee of the British Association for the Advancement of Science,† measuring more among the upper classes in London, found them to exceed both in height and weight the peasantry in Hertfordshire, near by. This need not disprove Dr. Beddoe's assertion. In fact, the contradictory evidence is very valuable for that reason. The only way to account for it is to suppose that the constant draft upon these suburban populations for their most powerful men, for service in the neighboring city as policemen, porters, firemen, and in other picked professions, has depleted the land of all its best specimens. Such an inflowing current always tends cityward. Everything points to the conclusion, on the other hand, that the final product of the continued residence of such sorted populations in the city is to divide them into the chosen few who succeed and rise socially, and the many who descend, in the social scale as well as in stature, until their line becomes extinct. As they differentiate thus, they migrate within the city. The few drift toward the West End, toward the Champs Elysées or Fifth Avenue, where they maintain the high physical standard of the quarter; the others gravitate no less irresistibly toward Cheapside and the Bowery.

We have seen thus far that evidence seems to point to an aggregation of the Teutonic long-headed population in the urban centers of Europe. Perhaps a part of the tall stature in some cities may be due to such racial causes. A curious anomaly now remains, however, to be noted. City populations appear to manifest a distinct tendency toward brunetteness—that is to say, they seem to comprise an abnormal proportion of brunette traits, as compared with the neighboring rural districts. The first notice of this is due to Mayr.‡ who, studying some 760,000 school children in Bavaria, stumbled upon it unexpectedly. Although blondes were in a very decided majority in the kingdom as a whole, the cities all contained a noticeable preponderance of brunette traits. This tendency was strikingly shown to characterize the entire German Empire when its six million school children were examined under Virchow's direction.* In twenty-five out of thirty-three of the larger cities were the brunette traits more frequent than in the country. In Metz alone was there a decided preponderance of blondes, due perhaps to the recent Germanization of Alsace-Lorraine as a result of political circumstances. Broadly viewed, all the larger cities, dating from the period prior to 1850, showed this brunette peculiarity in their school children.

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* 1867, p. 178.

† 1883, p. 20.

‡ 1875, pp. 299 and 305, with tables.

* 1885 and 1886 b, pp. 320 *et seq.*

Quite independently Dr. Beddoe discovered the same fact in the Rhine cities, basing his conclusions, however, entirely upon adults.* Here again, as in the case of the head form, we must reckon with the fact that city populations are always, by reason of intermixture, a mean, intermediate between the extremes presented by the country at large. So in northern blond Hanover the cities should contain more dark traits than the country; in Bavaria, on the contrary, we should expect them, for this same reason, to be somewhat more blond. Nevertheless, this would not account for the dark hair in certain Prussian cities, which contain more than twice as many dark as there are light traits; and in Bavaria, as we have seen, the actual condition is exactly the reverse of what might have been statistically expected.

Austria offers confirmation of the same tendency toward brunetteness in twenty-four out of its thirty-three principal cities.† Farther south, in Italy, it was noted much earlier that cities contained fewer blondes than were common in the rural districts roundabout.‡ The rule has been corroborated for the greater part of the country, since Livi # finds that even in the thirty-two darkest provinces, where towns tending toward the mean for the country should contain more blondes than the suburban districts, twenty-one of the capital cities show the reverse relation, while only nine conform to statistical probability. For Switzerland alone the evidence is conflicting.|| Applying the rule to the cities of the British Isles, Dr. Beddoe finds it to hold good especially in the color of the hair.^ So uniform is the testimony in this direction that those who, like Ammon ◊ and Lapouge, ↕ have ascribed the long-headedness of city populations to a predominance of the Teutonic racial type, now acknowledge this tendency toward brunetteness in spite, in this case, of ethnic probabilities to the contrary. The relative frequency, in fact, of long-headedness and coincidently of brunette characteristics induced Lapouge to designate this combination the "foreordained urban type." ↕ In conclusion, let us add, not as additional testimony, for the data are too defective, that among five hundred American students at the Institute of Technology in Bos-

* 1885, p. 211.

† Schimmer, 1884, p. xiii. For Tyrol, see comparative table in Toldt, 1894, and Virchow, 1886 b, p. 379.

‡ Raseri, 1879, p. 118. # 1896 a, pp. 70 *et seq.*

|| Studer, 1880, p. 59, says it holds good in Berne. Kollmann, 1883, p. 17, and Chalumeau, 1896 a, p. 8, affirm the cities to be more blond.

^ 1893, p. 114. See also tables in 1885, p. 160.

◊ 1896 d, p. 796. Ammon, 1893, p. 99, found dark hair more frequent in cities in Baden, but in eyes more variation.

↕ 1897, p. 85. ↕ Collignon, 1895, p. 123, apparently acquiesces in this view.

ton, roughly classified, there were nine per cent of pure brunette type among those of country birth and training, while among those of urban birth and parentage the percentage of such brunette type rose as high as fifteen. The arbitrary limit of twenty thousand inhabitants was here adopted as distinguishing city from suburban populations. Dark hair was noticeably more frequent in the last named group.

It is not improbable that there is in brunetteness, in the dark hair and eye, some indication of vital superiority. If this were so, it would serve as a partial explanation for the social phenomenon which we have been at so much pains to describe. If in the same community there were a slight vital advantage in brunetteness, we should expect to find that type slowly aggregating in the cities; for it requires energy and courage, physical as well as mental, not only to break the ties of home and migrate, but also to maintain one's self afterward under the stress of urban life. Selection thus would be doubly operative. It would determine the character both of the urban immigrants and, to coin a phrase, of the urban *persistents* as well. The idea is worth developing a bit.

Eminent authority stands sponsor for the theorem that pigmentation in the lower animals is an important factor in the great struggle for survival.* One proof of this is that albinos in all species are apt to be defective in keenness of sense, thereby being placed at a great disadvantage in the competition for existence with their fellows. Pigmentation, especially in the organs of sense, seems to be essential to their full development. As a result, with the coincident disadvantage due to their conspicuous color, such albinos are ruthlessly weeded out by the processes of natural selection; their non-existence in a state of Nature is noticeable. Darwin and others cite numerous examples of the defective senses of such non-pigmented animals. Thus, in Virginia, the white pigs of the colonists perished miserably by partaking of certain poisonous roots which the dark-colored hogs avoided by reason of keener sense discrimination. In Italy, the same exemption of black sheep from accidental poisoning, to which their white companions were subject, has been noted. Animals so far removed from one another as the horse and the rhinoceros are said to suffer from a defective sense of smell when they are of the albino type. It is a fact of common observation that white cats with blue eyes are quite often deaf.

Other examples might be cited of similar import. They all tend to justify Alfred Russel Wallace's conclusion that pigmenta-

* Dr. William Ogle, in Medico-Chirurgical Transactions, liii, 1870, pp. 263 *et seq.*

tion, if not absolutely necessary, at least conduces to acuteness of sense; and that where abundantly present it is often an index of vitality.* This eminent naturalist even ventures to connect the aggressiveness of the male sex among the lower animals with its brilliancy of coloring.

Applying these considerations to man, evidence is not entirely wanting to support De Candolle's (1887) thesis that "pigmentation is an index of force." Disease often produces a change in the direction of blondness, as Dr. Beddoe has observed; asserting, as he does, that this trait in general is due to a defect of secretion. The case of the negro, cited by Ogle, whose depigmentation was accompanied by a loss of the sense of smell, is a pertinent one. The phenomenon of light-haired childhood and of gray-haired senility points to the same conclusion. A million soldiers observed during our civil war afforded data for Baxter's † assertion that the brunette type, on the whole, opposed a greater resistance to disease, and offered more hope of recovery from injuries in the field. Dr. Beddoe finds in Bristol that the dark-haired children are more tenacious of life, and asserts a distinct superiority of the brunette type in the severe competitions induced by urban life.‡ It is not for us to settle the matter here and now. The solution belongs to the physiologist. As statisticians it behooves us to note facts, leaving choice of explanations to others more competent to judge. It must be said in conclusion, however, that present tendencies certainly point in the direction of some relation between pigmentation and general physiological and mental vigor. If this be established, it will go far to explain some of these curious differences between country and city which we have noted.

From the preceding formidable array of testimony it appears that the tendency of urban populations is certainly not toward the pure blond, long-headed, and tall Teutonic type. The phenomenon of urban selection is something more complex than a mere migration of a single racial element in the population toward the cities. The physical characteristics of townsmen are too contradictory for ethnic explanations alone. A process of physiological and social rather than of ethnic selection seems to be at work in addition. To be sure, the tendencies are slight; we are not even certain of their universal existence at all. We are merely watching for their verification or disproof. There is, however, nothing improbable in the phenomena we have noted. Naturalists have always turned

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* Address in Transactions of the British Association for the Advancement of Science, 1876, pp. 100 *et seq.*

† 1875, i, pp. 61 and 72.

‡ 1885, p. 223, and 1893, p. 115.

to the environment for the final solution of many of the great problems of Nature. In this case we have to do with one of the most sudden and radical changes of environment known to man. Every condition of city life, mental as well as physical, is at the polar extreme from those which prevail in the country. To deny that great modifications in human structure and functions may be effected by a change from one to the other is to gainsay all the facts of natural history.

Our long series of articles now draws to a close. It has been shown with what infinite pains, slowly through hundreds of generations, human beings in Europe have been shaping themselves to the conditions imposed by Nature. We have followed men in their migrations over the face of the continent; we have analyzed the forces making for change, which have played upon them; we have seen how tenaciously they have clung to the type of their ancestors throughout all the vicissitudes of ages. Whether twentieth-century urban life, with all the social changes which it implies, will finally eradicate all traces of ethnic descent remains to be seen. Certainly the pages of ethnic history, written in man's physical constitution, are rapidly blurring before our eyes. To be deciphered at all, they require the instant attention of European scientists. As for us in America, our field of investigation is mapped out with equal clearness. We know with some certainty, thanks to the unselfish and stupendous exertions of such men as Beddoe, Collingnon, Ranke, Livi, and a host of their fellows in Europe whose work we have been outlining, what is the raw material of which our heterogeneous American population is to be composed. They have analyzed the sources of the great human stream which is flowing continually westward to our shores. They have acquainted us with the physical character of the communities whence come those who, as immigrants, cast in their lot with America for good or ill. It behooves us at once to know whether we are drawing off the scum, the lees, or the pure waters in this inflowing tide. Then, again, we have to determine the effects of this novel life—its climate, its social conditions, its material prosperity, and, above all, its ceaseless intermingling of all strains and classes—upon the physical constitution of the original ethnic stocks. Such are the problems which confront us. May we take up the scientific burden where our European *confrères* must of necessity lay it down; and, in the same devotion to knowledge for its own pure sake, bear it a step further along the way!

THE GREAT SIERRA NEVADA FAULT SCARP.

By HAROLD W. FAIRBANKS, Ph. D.

THAT portion of California lying east of the crest of the Sierra Nevada Mountains has had a remarkable geological history. There are many phenomena to be witnessed in that region which possess much interest aside from their purely scientific aspect, and deserve to be better known than they are at present. The enormous scale on which faulting has taken place, resulting in the precipitous eastern wall of the Sierra Nevadas, and the variety and extent of the comparatively recent volcanic outbursts along the lines of fracture, bring the magnitude of geological processes vividly before our eyes. There are probably no better examples of topographic features due to the elevation and depression of great blocks of the earth's crust, through the formation of faults, to be found in any other portion of the world. From a scenic standpoint, also, the region is unique. The lofty, jagged crest of the Sierras rises over fourteen thousand feet, culminating in Mount Whitney, the highest peak in the United States south of Alaska, while in marked contrast to the ice and snow of these mountain heights are the hot and scorching wastes of Death Valley, which lies but a short distance to the east, depressed over three hundred feet below the level of the sea. Snow-clad mountain and desert sand, mighty earth blocks, volcanic craters, lava flows, and alkaline lakes—where can be found greater attractions for the student of Nature?

The Sierra Nevada Mountains, having a length of over three hundred miles and a width of seventy-five miles, consist essentially throughout much of their extent of one great block of the earth's crust, having been elevated along a north-and-south line through a series of movements which have been frequently repeated during a long period of geological time. The block as a whole was not elevated, but tilted from the east, so that on that side there is an abrupt wall many thousands of feet in height, while on the west the slope is long and gradual. Owing to this fact it is only when seen from some point at its eastern base that the magnitude of this range of mountains is appreciated. Although the valleys at the eastern foot of the mountains vary from three thousand to six thousand feet in altitude, the wall of rock forming the scarp rises so abruptly and with such colossal proportions that it is absolutely overpowering in its grandeur. To the east and running parallel with the Sierra Nevadas are other giant ranges formed in much the same manner, being only slightly lower but separated from each other by desert valleys.

The mighty eastern scarp in all its distinctness might be considered as beginning on the south in the vicinity of Walker's Pass. With a gentle curve it sweeps toward the north, rising higher and

MOUNT WHITNEY, FROM LONE PINE CAÑON.

higher for a hundred miles, until culminating in the jagged peaks northwest of Owen's Lake, where Mount Whitney reaches an altitude of fifteen thousand six hundred feet above the level of the sea. From this point there is only a slight descent for a hundred miles more, beyond which toward Lake Tahoe its extreme height and ruggedness are lost, the single fault line being replaced by several whose displacements are less. The scenic effect is grandest from Owen's Valley, where the mountain wall bounding it on the west, even and regular in its general outline save for the deep transverse gorges, rises eight thousand to ten thousand feet above the valley. Viewed from the Inyo Range opposite, the evenness of the crest is remarkable. The great peaks are not isolated, as is Mount Shasta, so that their individual grandeur is lost in the general effect. Owen's Valley has a length of about a hundred miles and a width of six to twelve miles, with an even sand floor much of the distance. On the edges the floor gradually slopes upward through the *débris* fans covered with sagebrush to the bordering mountains. The scenery of this valley is not alone due to the Sierra Nevadas, for on its eastern side, running parallel with the former mountains, is another range known at its southern end as the Inyo Range, and toward the north as the White Mountains. These, if less elevated and rugged, never-

theless possess remarkable proportions, rising five thousand to eight thousand feet above the valley and terminating in White Mountain peak, with an altitude of more than thirteen thousand feet. It will thus be seen that Owen's Valley occupies a troughlike depression between two parallel earth ridges or fault blocks. It also divides the arid from the non-arid regions. The crests of the two ranges are but eighteen miles apart, with this depression nearly two miles deep between them. The western wall is white with snow much of the year, and from its rugged cañons issue numerous streams utilized for irrigating the valley; the eastern range, on the contrary, is comparatively barren, snow lies on it but a short time, and running streams reaching the valley are rare. Owen's Lake lies toward the south at the lower end of the valley. Its greatest diameter is about eighteen miles, but it has no outlet and is quite shallow. It is probable that at one time its waters emptied southward through the continuation of this fault valley into the great wastes of the Salt Wells Desert. The water of the lake is impregnated with sodium

SIERRA NEVADA FROM THE LONE PINE HILLS.

chloride, sodium carbonates, and sulphates. The soda is present in such large amount that it is obtained in commercial quantities. When the water is evaporated in shallow ponds or tanks the carbonates of soda crystallize out first, and are thus easily separated

from the other ingredients. The lake is fed chiefly by Owen's River, but at the present time it is slowly sinking. Whether this is due to growing aridity of the climate or because so much water is taken from the streams for irrigation is not known.

As we go north from the upper end of Owen's Valley a vast table-land of lava and volcanic ash is encountered, extending to Mono Lake. On the extreme head of Owen's River the volcanic material rises to the summit of the Sierras, almost obliterating the fault scarp for a number of miles.

Mono Lake is nearly circular, with a diameter of twelve miles. It has an elevation of a little more than six thousand feet, being about two thousand feet higher than Owen's Lake, and like the latter extends up to the very base of the fault cliffs forming the eastern wall of the mountains. The water is intensely alkaline, quite closely resembling in composition that of Owen's Lake. It is situated in a depression in the sandy desert, being surrounded by sand and volcanic rocks on all sides except the west, where rise the snowy peaks of the Sierra Nevadas to an elevation of more than thirteen thousand feet. Although the mountains at this point are still very imposing, their grandeur does not compare with those farther south in Owen's Valley. As we continue northward toward Lake Tahoe it appears that there are two or more fault lines to be made out, the lake itself, according to geologists, occupying a depression caused by the sinking of one of these blocks.

The geological history of much of the region along this series of mighty fault fissures which have resulted in the formation of the Sierra Nevada Mountains is as yet not thoroughly known. The glacial history of Mono Lake and the adoining portion of the Sierras has been studied by Russell, and is better known than that farther south. It has been thought by Mr. Lindgren, of the United States Geological Survey, that, following the period of volcanic activity near the close of the Jurassic which finally culminated in the formation of enormous fused granite magmas, the portion of the crust embracing the Sierra Nevadas and the Great Basin became arched upward. As the result of this, a strain was set up which finally gave rise to north-and-south fault lines, and the region east of that now occupied by the Sierra Nevadas began to settle. This is supposed to have been inaugurated during the Cretaceous, and has continued at various times and in different amounts down to the present time. Toward the close of the Tertiary the displacement of the Sierra Nevada fault block was markedly increased, giving the range approximately its present outlines. There are many indications that an equilibrium has not yet been reached, as shown by the slip which took place at the time of the earthquake

of 1872. West of Mono Lake the total displacement can not be less than six thousand feet, while farther south in Owen's Valley it must have reached eight thousand to ten thousand feet, if not more.

Following the first faulting in the Cretaceous outlining the region occupied by the Sierra Nevada Mountains, the erosive agencies began to work actively, for the area was undoubtedly high and rugged. In the course of time the mountains were worn down in places to an approximately base-leveled condition, and erosion almost ceased. As a result of the renewed elevation in the latter part of the

GLACIAL ROUNDED BOWLDER, HEAD OF OWEN'S RIVER.

Tertiary, rapid erosion was again inaugurated and the present deep cañons were excavated. While these cañons on both slopes are exceedingly rugged, those on the east are very short, owing to the fact that the crest of the range almost overlooks the fault scarp. Those crossing this scarp have cut down nearly or quite to the level of the upper part of the *débris* fan which has grown up at their mouths. They are three thousand to five thousand feet deep, terminating upward in cirquelike amphitheaters of precipitous rock. Through the more rugged portion of the range the mountain peaks have in many instances flattened, plateaulike summits which present a

marked contrast with the steep walled cañons. This kind of topography is to be observed from a point south of Mount Whitney for more than a hundred and fifty miles northward past Mono Lake, and is undoubtedly the remnant of an old base-leveled condition reached during the early Tertiary and preceding the last important uplift. Mount Whitney even has an almost level summit, breaking away into vertical cliffs, which on its eastern side are over three thousand feet high, and form a portion of the cirque at the head of Lone Pine Creek. The plateaulike character is plainly discernible about Mono Lake, where it has been described by Russell.

At the mouth of each of the cañons debouching upon the desert there is a *débris* cone or fan of remarkable proportions. These fans have been formed by the radial distribution of the *débris* over the valley bottom below the mouths of the gorges whence the streams issue. The material of which they are formed consists of gravel and bowlders, and has been spread out over many square miles of the valleys. They are among the most striking features of the desert. The long, even slopes, sometimes reaching six to eight miles into the desert, terminate abruptly against the rocky walls of the mountains. To one not familiar with the desert they do not seem of such immense size, but if a climb is attempted this illusion is soon dispelled, for the slope is long and rough, covered with bowlders and intersected with dry water courses. Lone Pine Creek, heading under the great precipices of Mount Whitney, has many of these huge bowlders strewn along its course. By some their position might be attributed to glacial action, but in reality this is not the cause. Six miles below the mouth of the cañon there are some ten to twelve feet in diameter, while at various points one to three miles below occur others reaching a diameter of twenty to twenty-five feet. The swiftly flowing streams, at times augmented to torrents by sudden cloud-bursts upon the mountains, are enabled to do an almost incredible amount of work in transporting material.

At the close of the Miocene began the volcanic disturbances which modified so much of the old topography of the northern portion of the Sierra Nevadas. These flows were chiefly andesite with some rhyolite, and issued from fissures along the lines of faulting. The solid flows, breccias, conglomerates, and ash built up great ridges and mountains at many points. Between Lake Tahoe and Mono Lake much of the older surface was buried. From the latter lake southward for seventy-five miles there is a vast barren tableland, while between the North Fork of Owen's River and the San Joaquin the volcanic rocks reach up to and even form the crest of the Sierras for a number of miles. The volcanic eruptions continued through the Pliocene, and at its close occurred another eleva-

tion of the Sierras, making more marked still the great fault on its eastern side and differentiating it more completely from the region to the east. From the Mohave Desert northward, the whole length of the Sierras, these lines of weakness have given rise to an almost continuous line of volcanic craters and flows.

The Glacial period in the Sierra Nevadas was finally ushered in, being doubtless due to the increased elevation in this enormous fault block. Whether this period was contemporaneous with glaciation

GLACIAL LAKE, HEAD OF OWEN'S RIVER.

in the East is not known. There are many things, however, which lead us to believe that it was more recent here. Glaciers still exist in the shadows of the higher peaks, and the facts that their scourings are so fresh and the moraines so slightly modified are strong evidences in favor of the view that the ice period terminated very recently. The glacial phenomena about Mono Lake have been studied by Le Conte and Russell, but farther south they remain still almost unknown. Owen's River heads in the Sierras about forty miles south of Mono Lake. It is a stream of considerable size, draining a large basin, and issues from its rocky gorge at an elevation of eight thousand feet, thence flowing for many miles across the elevated volcanic table-land. Because of the elevation the immense glacier, which once gathered its strength in the basins of the fifteen

beautiful lakes that now exist there, flowed far out upon the volcanic mesa at the foot of the scarp, which here has very nearly obliterated the latter feature. The moraines are apparent for a number of miles, but just how far they extend has not yet been determined. This ice stream was probably the largest of any which issued from the mountains, a fact due in great part to the elevation of the mouth of the cañon. Lakes fill all the depression in the bed of this ancient glacier, illustrating how much the present scenic features of the Sierras are due to ice action. As we go south from the head of Owen's River into the valley of the same name it is apparent that only at its northern end did the glaciers reach as low as the

GLACIAL MORAINES, HEAD OF OWEN'S RIVER.

mouths of the cañons and flow out upon the *débris* cone. Opposite the highest and most rugged portion of the Sierras in the lower part of Owen's Valley, it is evident that the temperature was too high to permit the glaciers to reach an elevation as low as the valley floor. The size and symmetry of many of the moraines reaching into the valleys in the region of Mono Lake strike the attention at once. The Green Creek glacier in particular left morainal walls of great size and regularity. At the mouth of the cañon the flat valley is about half a mile wide, with steep and even walls of bowlders and gravel rising three hundred to four hundred feet.

Many of the lakes are due to the presence of the terminal moraines, while others fill rock basins.

Russell has described the terraces or gigantic stone steps by which many of the cañons rise, and the deep-walled cirques at their heads. About Mount Whitney these features are illustrated on a grand scale. The vast rocky amphitheaters at the heads of the cañons are bounded by precipitous walls one thousand to two thousand feet high, while their bottoms are generally occupied by lakes in basins of solid rock.

Lake Mono is at present gradually rising, thus differing from Owen's Lake. The history of these sheets of water has been a checkered one. Periods of high water have alternated with those of desiccation. The last high-water stage seems to have been contemporaneous with the glaciation. Well-defined terraces appear about Mono Lake, indicating the various stages of the water. In this region the opportunities for the study of the glacial phenomena are excellent, for only a small part of it has as yet been investigated.

What is perhaps of more interest than the glaciers is the recent volcanic action so remarkably exemplified about Mono Lake. Following the andesitic flows which took place near the close of the Miocene and in the early Pliocene, there were numerous eruptions of basalt, although some of the basalts of this region may be considerably older. South of Owen's Lake the basalt flows are numerous and extensive, volcanic action in that region being most strongly marked in the Coso Mountains. The most recent eruptions of all have, however, taken place in the vicinity of Mono Lake. Here the surface of the flows is often so fresh and free from soil that it seems as if they had but just cooled. From the lake southward for twenty miles there is a line of volcanic cones known as the Mono craters, which are connected with the most recent eruptions and possess great interest. The cones have been built up on extensive obsidian flows, the whole forming a considerable mountainous elevation. The glassy eruptions came first, then the cones were built up of lapilli and scoriaceous material, while the volcanic ash which covers the country for miles around was probably the last to be thrown out. These recent glassy lavas were very viscid and cooled in thick masses instead of thin sheets. This is finely shown in the southernmost of the eruptions, where the glistening, glassy mass which broke into fragments as it cooled rises in almost precipitous crags fifty to seventy-five feet. The bottom of the valley between two different *coulees* is occupied by a small stream which runs over an older lava. From the surface of the latter, which is covered with soil, spring immense pine trees which must have sprouted since the glass cooled, for no vegetation could have withstood the heat. A

climb over the sharply angular fragments which form the wonderfully rugged surface of the obsidian flow is an interesting experience. Great jagged points project up here and there from the broken surface, while the total lack of soil and the bright, clean surface of the brecciated glass makes it appear as though it were but yesterday when the seething mass welled up, overspread the surface, and cooled. Several circular depressions in the valley adjacent to the lava attract the attention. They appear like craters, but it is clear

DÉBRIS SLOPE AT FOOT OF SIERRA NEVADA FAULT SCARP NEAR OWEN'S LAKE.

that no lava ever flowed from them, and they were probably formed by some explosive action from beneath. The greatest body of ash, lapilli, and obsidian flows lies immediately south of the lake and constitutes the Mono craters. They present a weird appearance, rising in their nakedness from the sandy sagebrush plains with the dark background of pines to the south. The Mono craters can not be more than a few hundred years old. They certainly date from post-glacial times.

The two islands in Mono Lake are possessed of great interest, and are well worthy of a careful examination. They are largely volcanic, and present some exceptional geological features. The larger, known as Pa-o-ha, is about two miles long, and consists in part of stratified lake deposits raised up by some convulsion, while

the smaller, known as Negit, or Black Island, is wholly of volcanic origin. The lake beds on the larger island are faulted and generally much disturbed, but are probably not older than the Quaternary. The eastern and northern parts consist of a black basaltic lava, very fine-grained or even glassy. Much of it is younger than the sedimentary beds. The lava extends beneath the water on the northern side of the island in such a manner as to indicate that it flowed out during a stage of low water. At the southeast side hot springs issue from the lava just beneath the surface of the water. The bare rocks above are seamed and decomposed, and from holes and crevices there issue jets of steam which are visible for long distances in the cold weather. At the eastern end there are several peculiar craterlike depressions in the lava. One or two of them lie partly beneath the surface of the lake, and are being destroyed by the action of the waves. Several are, however, very perfect and symmetrical, about fifty feet deep, and as they extend beneath the lake level their bottoms are filled with water. No melted rock ever appears to have come from them, and there are several reasons for concluding that their origin is due to the same causes as those on the head of the North Fork of Owen's River already mentioned. This was the explosive action of gases beneath, completely shattering the massive lava and blowing out the material once occupying the depressions. It does not appear that any of this material could have been fused, for the fragments scattered around over the surrounding surface are all angular. Volcanic ash is strewn about and may have followed the explosions. A similar craterlike depression occurs in the sedimentary beds on the southern side of the island, and it can only be accounted for by a similar cause, or possibly by the falling out of the bottom.

Negit Island presents from a distance a dark, forbidding aspect. It is long and low, with a broad, truncated cone at its western end. A close examination shows this cone to be a mass of different colored lavas and scoria fissured and thrown into all kinds of shapes by earthquake movements. It is so shattered that it seems ready to crumble away and sink in the lake. The whole island has the appearance of having been elevated from beneath the water in very recent times, and shattered to its very center. On the eastern side the massive flows have evidently been lifted upward in such a manner as to leave great open fissures four to six feet wide and descending to unknown depths. From the level of the lake they are filled with water. These islands possess a most unique character, and, taken in connection with the Mono craters with their flows of acid lavas, illustrate volcanic phenomena more strikingly than almost anything else in the United States. The fact that the volcanic action has been so recent adds

greatly to its interest. The oldest lavas in the region seem to have been rhyolites and andesites, then followed basic andesites and basalts, and last of all the acid and glassy rhyolites of the Mono craters.

On the north side of the lake the tufas, built up by springs issuing from beneath the water, form a most interesting study. Great masses of calcareous material have been formed about the orifices

Obsidian Flow South of Mono Lake.

of these mineral springs, assuming odd and striking shapes. In the desiccated lakes of the desert in southern Inyo County these calcareous tufa deposits stand out in all their proportions.

It is probable that the forces producing the recent volcanic action are but slumbering, and that in the future, as in the past, movements will continue to take place along this great fault line bounding the Sierra Nevadas on the east. When the strain becomes too great, earthquakes will be felt and possibly followed by eruptions of lava.

The most severe earthquake of which we have any record on the Pacific coast of the United States was due to movement along this fault. On March 26, 1872, nearly the whole of California and Nevada was violently shaken. The loss of life was, however, confined to Owen's Valley. At Lone Pine, near the foot of the valley,

out of a population of about three hundred people, twenty-three were killed and sixty injured. Goodyear has described in detail the effect of this earthquake. After the event an examination showed numerous fault lines, extending as a general thing parallel to the base of the Sierras. Local areas sank, and in addition to the vertical movement there was a horizontal one amounting in some instances to from twelve to eighteen feet. Owing to the slight rainfall, the fault scarps left by this earthquake may still be seen. They indicate either a depression of the valley or an elevation of the Sierras to the extent of several feet. Russell mentions a fault cliff near Mono Lake of fifty feet which he thinks may date from this disturbance. It is clear that an equilibrium has not yet been reached, and there is no telling when the shocks may be repeated. These things forcibly remind us that geological processes are going on to-day as in the past. The common phenomena around us teach the same thing, but we become so used to them that they are not noticed, and it is only when our attention is called to some great example, something out of the ordinary, that we realize the transitoriness of even the great mountains.

I have thus tried to trace in a general way the history of the fault fissures and the great mountains and deep valleys produced by them along eastern California from their inception in the Cretaceous down to the present. Many of the geological phenomena connected with this subject are without doubt displayed on a grander and more imposing scale in this region than anywhere else in the United States.

It is related in William Vogt's *Vie d'un Homme* (Carl Vogt) that one evening Vogt, Helmholtz, and Kopp were talking about fish culture with the proprietor of an inn near Heidelberg. The innkeeper, who practiced in the art, expressed his contempt of all the books that pretended to treat of it—saying that the whole lot was not worth a mug of stale beer. Some were obscure, others wrong, and others incomplete ; and one could see in an instant that they were all written by closet naturalists who had never one of them caught a gudgeon. Helmholtz and Kopp enjoyed his remarks greatly as a joke at the expense of Vogt, who had written a book on the subject, and laughed at their comrade. The innkeeper was gratified at the signs of approval of what he had said, and continued : "Now I think of it, gentlemen, I must make one exception. I have a book published by Brockhaus at Leipsic, with pictures in the text, that is worth more than all the rest together. It is written by a man who knows all about the subject, who we perceive at once has seen with his own eyes and tried his methods himself. I will show it to you." The man withdrew and returned with the volume. "Here it is ! it has just been published. It is called *Die künstliche Fischzucht*" (Artificial Fish Culture), "by Prof. Carl Vogt, professor in Geneva !" It was Vogt's turn to laugh.

PHYSICAL TRAINING IN THE COLLEGES.*

By FRED E. LEONARD, M. D.,
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IT is a conspicuous fact that within the last two decades of the present century our foremost colleges and universities, with few exceptions, have been providing for the physical training of their students by the erection of gymnasia which in many instances rival the other buildings on the campus in size and cost, and by assigning the direction of the work done in them to some officer supposed to possess special qualifications for his position. In such recently founded institutions as Leland Stanford and Chicago Universities, the chair of physical training has been among the first to be filled, and the gymnasium has followed close upon the library.

The wisdom of this new departure in college education is apparent. Many a student is physically defective when he enters upon the course of study. The general muscular development of thirteen out of the last one hundred men examined at Oberlin was noticeably poor, eighteen were flat-chested, more than a third stood with head and shoulders drooping forward and abdomen protruding, an equal number were flat-footed, and nearly as many carried one shoulder considerably lower than the other. Deficient mobility of the chest walls, irregularities in the heart's action after exertion, nutritive disorders, abnormal susceptibility to colds, evidences of exaggerated nervous irritability and of faulty muscular control are frequently observed.

The conditions of college life, too, favor physical carelessness. The current sets strongly in the direction of mental effort. The scholar's ambition is aroused, his circle of interests widens, he realizes the need and the possibilities of intellectual attainment. Under the urging of teachers the successful student is likely to apply himself too continuously to his books; the poor student, or the one who is unused to study, may be compelled to exert himself to the utmost in order to keep up with his mates. Social distractions make their demands upon spare moments, and outside interests multiply as the end of the course approaches. The claims of the body for a reasonable share of care and training are easily overlooked, unless there is some organized attempt to enforce them.

It is during these very years of student life, moreover, that the growth period of the body comes to an end. This growing period is

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the impressionable one. The bones are being consolidated, the chest is taking on its final shape, respiratory and circulatory power can still be increased, the nervous system is wonderfully responsive to training, and the possibilities of attainment in muscular control are at their highest. Never again can correct habits of carriage and action be so easily established, and the human machine be brought so completely under the control of the will and made its ready servant.

Student athletics, although they form an important part of the necessary physical training, are not sufficient. So far as they go they are invaluable, drawing the student out of doors and away from the routine of school life, and affording exercise made vigorous by the stimulus of competition. They help to counteract influences that tend to overrefinement and effeminacy. They demand and develop presence of mind, alertness, physical courage, self-control. But even the size of the playgrounds which they require makes it impossible that they should reach all the students in any but a small institution. They attract the most proficient, not the most needy. They have their place in the fall and spring, but must be given up entirely, or only occasionally practiced, during the four or five months of the year when the temptation to physical inactivity is greatest. They leave untouched some of the commonest physical defects. They are largely lacking in careful supervision, system, gradation, adaptation to individual needs. They can be compared to the student's general reading, rather than to his serious study. In a word, though they yield the recreative and hygienic results of physical training, they are lacking in the corrective; they are educational, but only in a haphazard sort of way.

Amherst College, in 1860, was the first in America to establish upon a sound basis a department of physical training, placing at the head of it a thoroughly educated physician, a member of the college faculty, with the title of Professor of Hygiene and Physical Education. Dr. Hooker, the first incumbent of the chair, was succeeded a year later by Dr. Edward Hitchcock, whose period of service has been an unbroken one from that day to this. Nearly a score of years passed before Harvard College (1879) became second on the list, by appointing Dr. D. A. Sargent assistant professor of physical training and director of the Hemenway Gymnasium, which had been erected at a cost of more than a hundred thousand dollars. Within more recent years the same thoroughgoing provision has been made by Bowdoin, Cornell, Oberlin, the Universities of Pennsylvania, Michigan, and Wisconsin, Leland Stanford University, and a number of smaller institutions. Yale has two associate directors of the gymnasium who are physicians, but they are not given entire charge of the department. At Brown and the University of Chicago the de-

partment is well organized, but is not under medical direction. Few of the other colleges of recognized standing are without a director of the gymnasium, but too often they have been content with the erection of a showy building, instead of looking to the organization of an efficient department; it has not been put upon an equal footing with other departments of instruction and expected to do the same quality of work; the same grade of general culture and special preparation has not been exacted from its head.

Of the colleges for women, Smith, Vassar, Wellesley, Bryn Mawr, and Mount Holyoke all have college physicians, in most cases giving instruction in physiology or hygiene, or both. Each has in addition a director of the gymnasium, but only at Bryn Mawr is she a medical graduate. None of these directors is given the rank of professor in the faculty, but they are better qualified for their positions than are many of the male directors. The Woman's College of Baltimore is the best organized, with a professor of anatomy, physiology, hygiene, and physical training, and two instructors in physical training.

The completion of the Hemenway Gymnasium at Cambridge, Massachusetts, in 1879, marked the beginning of the present era of gymnasium building in American colleges and universities. The example of Harvard was followed during the next decade by Amherst, Cornell, Johns Hopkins, Bowdoin, Williams, Lehigh, Bryn Mawr, Vassar, and some others; and among the large number added to the list since 1890 are Yale, Wesleyan, Brown, Rutgers, Colgate, the Universities of Michigan, Wisconsin, and Chicago, Leland Stanford, Smith College, and the Woman's College of Baltimore. The cost of the better class of these buildings ranges from ten thousand dollars to two hundred and fifty thousand dollars, the average being not far from fifty thousand dollars.

A typical gymnasium of the period may be described somewhat as follows: It is built of brick or stone, several stories high, with a basement. The large main hall, containing the bulk of the apparatus, is open to the roof, unobstructed by posts or pillars, surrounded by a suspended gallery for the running track, and crossed above by iron beams to which the swinging apparatus is attached. On the floor below, or in the basement, are lockers in which the clothing worn during exercise is stored between times. Here, too, is a very important feature, the bathing equipment, consisting commonly of a plunge bath, tubs, and a considerable number of shower and spray baths. There are also the director's office and examining rooms, rooms for special developing appliances, or for boxing, wrestling, and fencing, perhaps bowling alleys in the basement, a "cage" for indoor baseball or tennis, an athletic trophy room, and others for the use of

janitors, for the heating and ventilating plants, fuel, etc. The whole building is heated by hot water or steam. The apparatus in the main hall is partly portable, including wooden and iron dumbbells, Indian clubs, and wands; there are pulley weights, arranged to exercise all the principal groups of muscles, and adjustable to suit all grades of strength; fixed or "heavy" apparatus, comprising such forms as the horizontal bar, parallel bars, ladders, ropes, poles, swinging rings, the horse and buck for vaulting; and provision is also made for a variety of simple throwing and running games.

Before the student enters the gymnasium he is generally called upon to submit to a physical examination. In some schools this is required of every student, whether he goes to the gymnasium or not; in others it is optional for all, or confined to those in actual attendance. Its extent and thoroughness vary with the training and character of the examiner and the time at his disposal; but there is a general uniformity of method throughout the country. The most complete form includes (1) a record of certain facts of family and personal history which may explain abnormal conditions, if these are present, and direct attention to probable tendencies. Among such facts are the nationality and longevity of grandparents and parents, the environment and health of parents, the father's occupation, diseases common in the family or thought to be hereditary, personal injuries and diseases, habits regarding physical and mental work and recreation, sleep, life in the open air, the use of stimulants and narcotics; (2) a systematic inspection of the whole body, recording such points as apparent temperament, general muscular development and condition, the position of head and shoulders, deviations from the normal curvature of the spinal column, shape and mobility of the chest, proportionate development of various groups of muscles, and abnormalities of whatever sort; (3) a medical examination of the heart and lungs; (4) a series of about fifty measurements of weight, height, various lengths, breadths, and depths, the girths of trunk and limbs at different levels, followed by tests of lung capacity, and of the strength of large muscular masses—for example those of the chest, back, front of thighs, upper arms, and forearms.

In many instances, and especially where the director is without medical training, the examination is much less complete, and covers little more than a few facts of history and a series of measurements and tests. These may be of value as a means of interesting the student in his own development and furnishing data for future comparison, but by themselves they are almost worthless as an index of physical health and proficiency, or as a ground for special instructions. They need to be supplemented and explained by inspection, and by other means of examination and diagnosis. But if the work

has been thoroughly done, the director has at hand a valuable fund of information to be used in framing advice suited to the needs of the individual, and the study of hundreds of such cases together may yield important deductions concerning the characteristics of the student class. In this way a variety of graphic charts have been prepared, upon which the measurements and tests of the individual can be plotted, so as to show at a glance his relation to an imaginary standard. It is true, however, that much of the chart-making hitherto done has been of trifling scientific value, based upon insufficient data, or the result of superficial methods. This study of men in masses should not lead to the neglect of the individual, who, after all, must be compared with *himself*, with his own latent possibilities.

There is so much diversity in the methods of physical training employed in our colleges and universities at present that a satisfactory summary is difficult to give. As elsewhere in this paper, where names of institutions are used by way of illustration no attempt is made to furnish complete lists. A few schools, like Bowdoin and Leland Stanford, allow credit for work done in the gymnasium, just as for any course in the laboratory or classroom. Regular attendance during the four years of undergraduate life is required at Amherst, Bowdoin, Brown, University of Chicago, Bryn Mawr, Smith, Vassar, and the Woman's College of Baltimore. The requirement extends only through the junior year at Mount Holyoke and the women's department at Oberlin; through the sophomore year at Wesleyan and the University of Wisconsin; and is confined to the freshman year at Cornell, Dartmouth, Williams, and Wellesley. Attendance is altogether optional at Harvard, Yale, Princeton, Johns Hopkins, and the Universities of Pennsylvania and Michigan.

The nature of the work done can be shown with tolerable accuracy by the selection of certain types. The results sought at Amherst are hygienic and recreative, rather than corrective or educational. The men meet by college classes, each of which elects its captain. The characteristic feature is a memorized series of exercises with wooden dumb-bells, set to music and executed by the entire class under the leadership of its captain. The men are required to be present and to take part, but beyond this there is little attempt at discipline. They have a good time, all the functions of the body are stimulated by the vigorous exercise, and the spirit of class rivalry, intensified by a system of prize exhibitions, insures a degree of proficiency. The use of the fixed apparatus is optional, and not much is made of prescription work for the individual. This plan, while it has given general satisfaction at Amherst for many years, has not been introduced into other schools to any extent. It owes much of its success to the peculiar conditions existing there, and to the per-

sonality of the beloved director, Dr. Hitchcock. Some of the features have been adopted at Cornell, where, however, the work has to be combined with a system of military drill.

The conditions at Harvard are quite different. The number to be provided for runs up into the thousands. The system of electives abolishes class lines, and forbids an arrangement of the schedule which would leave certain hours free for exercise. It therefore becomes next to impossible to group the men for graded instruction, and prescribed work for the individual has been adopted as offering the best solution of the problem. Dr. Sargent's series of widely known and used pulley weights, adapted to a wide range of wants and strengths, was devised to render more efficient the making and carrying out of these prescriptions. While such a plan is admirably suited to the needs of Harvard, it has been a mistake to introduce it so extensively into schools where the age of the pupils renders more constant supervision and direction desirable, and where instruction can be given in graded classes, with the added incentive that comes from working in company with others. The use of the so-called developing appliances secures results which are corrective, and in a measure hygienic, but they lack recreative and educational qualities.

What has been said of Harvard will apply in the main to Yale, though there the interest in athletics overshadows all else. At Bowdoin a system of applied athletics, or competitive gymnastics, is the distinguishing feature. The freshmen, in addition to their prescribed corrective exercises, are given a preparatory discipline in military tactics and Indian-club swinging. The sophomores receive class instruction in the elements of boxing and wrestling, with supplementary squad work on the fixed apparatus (horizontal bar, parallel bars, flying rings, etc.), the squads being arranged in three groups graded according to strength and skill. The juniors learn to fence with single-stick and broadsword, and the seniors with foil and mask. The results sought are clearly educational, as well as corrective and hygienic. The work at Brown, though it differs in details, can be referred to the same type, except that military drill is required in the fall and spring of the freshman and sophomore years, under an officer in the United States army.

Where the work is required only during the early part of the course, or for a term or two, it is in too many instances unworthy to be called scientific or pedagogic. It is usually a combination of prescribed exercises for the individual and memorized class drills with light apparatus, together with optional use of the fixed apparatus. It has, to be sure, some corrective and hygienic value while it lasts, but is likely to grow monotonous, and is dropped before it has accomplished much in the way of genuine training. It can not

be too strongly insisted that proper grading of classes, careful selection and arrangement of teaching material, progression in each lesson and throughout the series of lessons, and skillful adaptation of methods to meet local conditions, are of fundamental importance in physical training, as they are in other phases of educational effort.

Some surprise may be excited by the statement that at the present time the most painstaking and satisfactory work is being done in the colleges for women, but it is probably true. The college officers are as a rule more alive to the importance of the department, the teachers are with few if any exceptions graduates of normal schools of gymnastics which require two years of study, and the disturbing element of athletics does not enter so largely into competition with efforts at systematic physical training. At the Woman's College of Baltimore the system employed is purely Swedish, and the instruction is given by two graduates of the Royal Normal School of Gymnastics in Stockholm. The same system is employed, though less inflexibly, at Smith College. Bryn Mawr and Vassar have a combination of individual work and class instruction with light apparatus, making most of the former. The work at Mount Holyoke is somewhat the same, but more varied. At Wellesley athletics receive a relatively larger share of attention.

It will not be out of place to refer, in conclusion, to a source of instruction and suggestion almost unknown to the great majority of the directors of American college gymnasia. We in this country have been greatly benefited by the study of Swedish gymnastics; but any one who comprehends the wealth of the German literature of gymnastics, and the extent and variety of the experience of which it is the outcome, must regret the fact that it has been hitherto so generally overlooked. It offers an inexhaustible storehouse of material which will be found especially helpful in planning courses in physical training for advanced classes in our institutions for higher education.

MATTHEW ARNOLD, though best known as a literary man, did equally valuable work in education, with which he was closely connected for a long series of years as inspector; and Sir Joshua Fitch, in his biography of him, credits him with having exerted a real and telling influence on schools and done much indirectly to raise the aims and the tone of teachers; and, the biographer says, "if he saw little children looking good and happy, and under the care of a sympathetic teacher, he would give a favorable report, without inquiring too closely into the percentage of scholars who could pass the examination. He valued the elementary schools rather as centers of civilization and refining influence than as places for enabling the maximum of children to spell and write, and to do a given number of sums without a mistake."

THE ACADEMY OF NATURAL SCIENCE OF ST. LOUIS.

By Prof. FREDERICK STARR.

IN 1837 St. Louis was scarcely more than a small frontier town, yet in that year there was organized, through the efforts of two young men of foreign birth, what was perhaps the first society for scientific research established west of the Alleghany Mountains. The prime movers were George Engelmann and Frederick Adolphus Wislizenus. The new society was called the Western Academy of Science. It was progressive and enterprising, and even as early as

Dr. George Engelmann.

B. F. Shumard.

1840 made an effort to establish a botanical garden at St. Louis—an effort that failed. Interruptions and discouragement came, and finally the pioneer society ceased to exist.

It was nearly twenty years later that the Academy of Science of St. Louis was born. Organization must have taken place and some things must have been done in 1856. In the list of organizers were the two names of Engelmann and Wislizenus. In January, 1857, the academy was incorporated. The list of incorporators reads: "George Engelmann, Hiram A. Prout, Nathaniel Holmes, Benjamin F. Shumard, Charles W. Stevens, James B. Eads, Moses M. Pallen, Adolphus Wislizenus, Charles A. Pope, Charles P. Chouteau, William F. McPheeters, and others."

The organization of the society, as shown by its standing committees, was sufficiently detailed and heavy to kill a modern society.

There were standing committees in the following subjects: Ethnology, comparative anatomy, mammalogy, ornithology, herpetology and ichthyology, chemistry, geology and malacology, entomology, botany, paleontology and geology, mineralogy, chemistry, physics, embryology, and monstrosities. But the academy was incorporated to last, and it survived.

There had been preliminary meetings, but the first regular meeting was held March 10, 1856, in the hall of the Board of Public Schools. George Engelmann was elected president and Benjamin F. Shumard secretary. At the second meeting active work was begun. At that meeting the well-known name of Dr. Koch first appears. He then presented to the museum a plate of Koch's *Missourium*. The *Missourium* (truly *Mastodon giganteus*) played a lively part at one time in geological and archæological discussions in this country. Dr. Koch at this meeting offered to visit Mississippi for the academy, and investigate certain finds recently made of the remains of *Zeuglodon*—a gigantic fossil whale. This was probably the first investigation made at the expense of the new academy. Dr. Koch visited Mississippi, made his investigations, and collected a lot of fossils from Tertiary and Cretaceous formations.

CHARLES P. CHOUTEAU.

Among the original members was Mr. Charles P. Chouteau, one of two out of that list of incorporators who still lives. Mr. Chouteau, a man of business and means, never permitted his intelligent interest in the academy and its work to flag. Connected with the fur trade, his business took him or his representatives on frequent journeys into the far West. Such expeditions were enormous enterprises in those days. At that time even journeys to the East were no trifles. Mr. Chouteau—after recently making the trip from St. Louis to New York in twenty-four hours—narrates that on one occasion, when a young man, he was sent to New York to see Mr. Astor on im-

portant business. He made the journey in three weeks, a time so short that his statement was deemed almost incredible in Mr. Astor's office. One can only imagine, then, how great was the undertaking of a journey up the Missouri, across the plains, and through the mountains. From the start it was the policy of the academy to cultivate a museum. At that same second meeting when Koch offered to go zeuglodon-hunting, Mr. Chouteau generously offered to place the Bad Lands collection of fossils collected by Dr. F. V. Hayden—for that time a large and important collection —in the academy museum, donating his one-fourth interest in it to the society. Not long after he showed his cordial interest by " desiring the academy to name some naturalist to accompany him on his expedition to the upper Missouri this summer free of expense to the society." More than once afterward Mr. Chouteau took some naturalist or scientific man with him on similar expeditions into the far Northwest.

The old Western Academy of Science had done something toward securing property, and in 1856, at the meeting of August 4th, its library, collections, cases, and apparatus were transferred to the new society. A special meeting was held for receiving the transfer. Unfortunately, nothing of this donation remains to-day except the seal and the little book of old proceedings.

The academy was fortunate in having in its membership from the start men who were interested in science and able to conduct independent investigation. Shumard, Swallow, and Eads were professional scientists; Engelmann, Prout, and Wislizenus, while busy professional men, were original investigators in more than one field. From the very beginning of the society's history, the idea of work, rather than play or recreation, was present; not only was a museum to be gathered, but papers read at the meetings were to be printed. We find, accordingly, by the end of the third year of the academy's life, that two numbers of Volume I of their Transactions had been printed. These had been widely used in exchange, and more than one hundred and eighty societies in the United States, Canada, Mexico, Cuba, Chili, Asia, and Australia had entered into relations with the academy. The six volumes of the Transactions now in print are bulky tomes—the first containing 716 pages. That included many important papers. Geology naturally occupied a prominent place in a society where the Shumards, Swallow, and Prout were leading spirits, and in their publication many new species of fossils were described, and many papers regarding formations and the stratigraphical problems of Missouri, Kentucky, Kansas, and other Mississippi Valley and central States were presented. We have already stated that one quarter of the Hayden collection of Bad

Lands fossils had been given to the academy by Mr. Chouteau. About the middle of 1857 the academy bought the one fourth which belonged to Mr. Vaughan. While all these things indicated that the academy was particularly favored in its early years, it would be a great mistake to think that it found only easy sailing. While its ideas were broad and its membership active, while its papers were of scientific value and its proceedings were eagerly sought in exchange, the financial problem was serious. Thus Prout says, in 1862: "Surrounded by difficulties and embarrassments, without means and without patronage, we have struggled on and struggled successfully. We had hoped that, ere the present moment, some friend or friends of science with enlarged and liberal ideas would have extended to us a helping hand, and placed us in a condition to give the world a more ample exhibition of the fruits of our labors. But for the generous liberality of one of our members we should not now have a place to hold our meetings or to garner up the treasures which have been so liberally contributed to our museum; and, again, those objects lose part of their interest for the want of appropriate casing in which they could be scientifically arranged and classified." In fact, the mere publishing of the Transactions was a heavy burden; the fees were not adequate to the task, and private gifts were solicited to continue the work. It was war time, and St. Louis particularly felt the disastrous effect of the strife. Men were too busy with political affairs, too anxious regarding what a day might bring forth, to contribute much for the encouragement of science. Even these circumstances, however, had some conpensations. An institution of learning—McDowell College—was changed into a war prison, Gratiot Street Prison. The military authorities transferred its collections to the academy, and we find the following resolutions in the minutes: "Resolved, that the thanks of the academy are due to Major-General Curtis, as also the members of the Western Sanitary Commission, for interest taken by them in the preservation of what remained of the McDowell Museum of Natural History when it fell under their control; and that Captain Curry, of the Tenth Missouri Cavalry, and the men under his command are entitled to our special acknowledgment for the zeal and fidelity with which the order of General Curtis for the removal of the collection to the halls of the academy was executed by them."

The first recognition of the academy, so far as we know, was by the Academy of Science of Philadelphia, which early—presumably before any publications had been made by the new organization—donated its Transactions and the second set of its journal. In 1866, when the St. Louis Academy had passed its first decade, we find her playing a similar magnanimous part to other institutions. At that

time the Portland (Maine) Society of Natural History had just met serious loss from fire. It was therefore resolved that the academy should donate to the unfortunate society a full set of its Transactions, together with minerals and other museum specimens. The Chicago Academy of Science having suffered in a similar way at the same time, a like courtesy was extended to it.

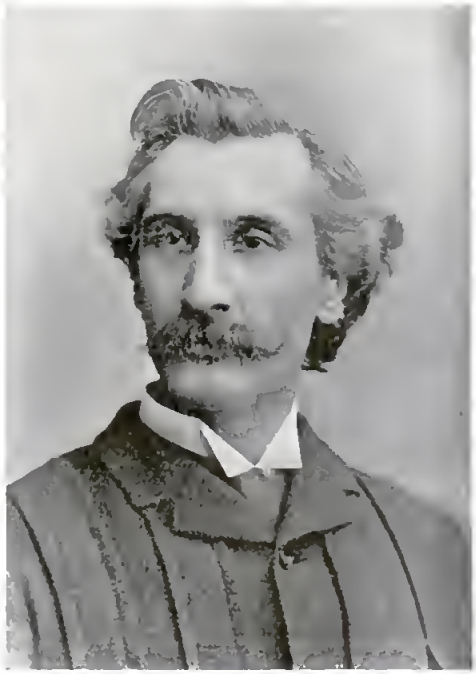
It will be remembered that the first meeting was held in the rooms of the Board of Public Schools. Nearly or quite all the following meetings for a long time were held at the local Medical College, in O'Fallon Hall, through the courtesy of Dr. Pope at first, and later through that of his successor, Dr. Hodgen. Twelve years of the life of the academy passed thus, when an effort was finally made to secure new rooms in the building of the Polytechnic. A committee was appointed September 2, 1868, in this matter; the negotiations went on for some months. The museum of the academy was by this time distinctly creditable. Mammals of the Rocky Mountains were the result of Mr. Chouteau's interest. A fine meteorite from Nebraska had been secured; sections cut from it had been exchanged for similar pieces from other localities, until thirteen meteoric falls were represented. The chief importance of the museum, however, was in paleontology; the Hayden collection has already been mentioned; there were also important local collections; among foreign matter was a particularly fine complete skeleton of the cave bear. Just at the time when the museum's prospects were so good, May, 1869, fire broke out in the Medical College building, and the whole museum was swept out of existence. The only valuable specimens left uninjured were a skull of *Bos cavifrons*, some mastodon vertebræ, and several meteoric specimens, including the original piece from Nebraska. Fortunately, the library was saved, and the greater part of the Transactions, though some of these were injured by water.

During this year, just before the fire, the president, Benjamin F. Shumard, died. He was born at Lancaster, Pennsylvania, November 24, 1820. His taste for science may have come to him from his mother's side; her father, a Mr. Getz, was an inventor and a maker of instruments of precision. When Benjamin was still young, his father removed to Cincinnati, and the boy was sent to Oxford for his college education. He returned to his native State to pursue his medical course, but had hardly well begun his work when his father removed to Louisville, Kentucky. The result was that the young man completed his studies in that city, graduating in 1846. His practice began in that State, first in the interior, later in Louisville. The young physician's leisure was devoted to the study of local paleontology and zoölogy. Making some reputation,

he was appointed by David Dale Owen to an assistant's position upon the Geological Survey of Iowa, Wisconsin, and Minnesota. In 1850 he was Dr. John Evans's assistant in a geological reconnoissance of Oregon, and spent the greater part of two years in the field. In 1852 he returned to Louisville to work out his report, and to assist his brother in preparing for publication the paleontological results of the Marcy Red River Expedition. In 1853 Dr. Shumard removed to St. Louis to serve as an assistant upon the State Geological Survey organized under Prof. G. C. Swallow. In 1856, appointed State Geologist of Texas, he made a study of the remarkably complete series of rocks occurring in the eastern and central part of that State. The war interfered with his work, which was never resumed. Returning to St. Louis, he died there, April 14, 1869.

Prof. George Clinton Swallow forms one of the striking features in the early history of American geology. On one occasion Prof. A. C. Ramsay, the eminent director of the Geological Survey of

G. C. Swallow.



Prof. Charles V. Riley.

Great Britain, said: "I will say that the names of Dana and Hall, and Hitchcock and Rogers and Silliman and Swallow, and your other scientific men, are as familiar in our mouths as household words." Born on a farm, at Buckfield, Maine, in 1817, George C. Swallow had no great opportunity for education. With ambition and purpose, however, he pushed his way, and in 1843 graduated from Bowdoin College. His interest was chiefly in chemistry in its practical application to agriculture. Immediately on graduation

he was appointed lecturer in botany at Bowdoin, and gave the first courses in that subject at that institution. Shortly after, as principal of Hampden Academy, he had an opportunity long desired, and interested the State Legislature in experimental agriculture. The Legislature gave him a grant of land, and he at once organized a system of agricultural experimentation and a laboratory of agricultural chemistry. In 1850 he removed to Missouri, where he had been appointed to the chair of chemistry and geology in the State University. His influence in the State was at once felt. An address made by him, in 1852, led to the organization of the Agricultural and Mechanical Associations of Boone and St. Louis Counties. Such associations, for the benefit of farmers and interchange of ideas in agriculture, were then rapidly organized throughout the State. In 1853 Professor Swallow took charge of the State Geological Survey, which he conducted for seven years. The scientific results of this work were of the utmost value. The existence of Permian rocks in this country was demonstrated by it, and many other facts in stratigraphy and paleontology brought out. Nor were its practical results less striking. The twenty-seven thousand square miles of coal beds in Missouri were unknown before its time. The civil war brought the survey to an end. In 1865, appointed State Geologist of Kansas, Professor Swallow worked there for two years. In 1870, returning to Missouri, he was given the chair of agriculture and geology in the State University. Later he was made dean of the College of Agriculture. After many years of faithful work for Missouri, Dr. Swallow removed to Montana, where he has had much to do with the development of mining interests. He still lives, a happy and respected octogenarian, with an honorable career behind him.

Garland Carr Broadhead came of good English and English-Scotch ancestry. He was born in Albemarle County, Virginia, October 30, 1827. In September, 1836, his father moved to St. Charles County, Missouri. His early instruction was gained from his parents and from private tutors, but in 1850 he went to the State University at Columbia, where he first became interested in geology. With the intention of becoming a civil engineer, he then attended the Military Institute of Kentucky. There he met Colonel Richard Owen, brother of David Dale and Robert Dale Owen, and his interest in geology was greatly increased by this acquaintance. In 1852 he began professional work in railroad construction and map-making in Missouri. After four years on the railroad he accepted the appointment of assistant in the State Geological Survey, which he retained until the work was discontinued in 1861. From that time on until 1868 he was in railroad or national Govern-

ment service. In that year he resumed work in pure science as assistant on the Illinois State Geological Survey. On the reorganization of the Missouri State Geological Survey he was appointed assistant, and in 1873, as State geologist, took entire charge. The survey was discontinued in 1875. Mr. Broadhead has continued to contribute to geological science since that time as juror in expositions, expert in Government service, and otherwise. In 1887 he was appointed to the chair of mineralogy and geology at the State University at Columbia, S. C., which he still holds.

After the fire and Shumard's death, it is no wonder that signs of discouragement showed themselves; no wonder that in his annual address—the fifteenth—Dr. Engelmann mourned the condition of affairs. The membership of the society was reduced. "Some are dead, others have removed from here, and few remain to help the work, and this is the greatest difficulty we labor under; scarcely any have come to St. Louis to step into their places and work, no new generation grows up to take the work when the pioneers of the academy have departed." There had at this time been no publication since 1868, hardly anything since 1866; on the whole, it was the darkest hour of the institution's history. New life and new energy were to come. The school board, with whom they had been so long negotiating for new quarters, acted with promptness after the fire, and meetings were held in their rooms, and later in the Polytechnic Institute; in November, 1871, the school board voted five hundred dollars for cases in the institute; in January following the St. Louis Public-School Library offered to pay for the bindings of the unbound books. In January, 1872, there began negotiations looking toward a permanent home. At that time, James H. Lucas proposed to present a plot of ground to the Missouri Historical Society for a building. President Johnson, of the academy, secured permission for the institution to co-operate in the building. On June 8th Mr. Lucas presented a lot of fifty by one hundred and nine feet, on condition that the two societies should put up a joint building. Both of the organizations took up the matter; committees were appointed, various plans and schemes were suggested or attempted; fifty thousand dollars was the sum to be secured. The subscription did not go well; plan after plan was tried; appeal after appeal was made in the presidential reports. Local pride was prodded by reference to a sister institution: "Davenport, Iowa, is about to dedicate a building to the service of science, and the funds to erect it were obtained almost wholly by the persistent efforts of a single lady." The original gift was conditioned upon the building being begun within five years after the donation; at the request of the society this condition was modified. Finally, after seven years had passed, in

1869 Dr. Engelmann advised giving up or selling their share in the lot and purchasing the Mary Institute—the female branch of the Washington University—for the purposes of the academy. Twenty-five thousand dollars would buy the building, of which five thousand was already promised; twenty-five thousand dollars more would be needed for equipment. In 1882, when the society had reached the age of twenty-five years, it was still without a home; it had just moved, however, into the Washington University, where it had a meeting room and space for its small museum and library free of rent. In 1893 the plan for building was revived, but failed, and to-day (1897), when forty-one years have passed, the society is still homeless. Its interest in the Lucas lot was long since converted into cash, and forms part of its present fund. The Historical Society has become the owner of a well-located building, and the academy occupies quarters at present in it. A meeting room is situated on the ground floor; it is supplied with oil portraits of the presidents and prominent past members of the academy. In upper rooms, not particularly easy of access and not at all adapted to their use, are a reading room and the library. Here, too, is stored away the supply of Transactions held for distribution. No attempt has been made for some years to secure museum collections, and what few specimens the academy owns are either stored away or displayed in some other institution.

Although the publication of the Transactions had at one time been almost discontinued, three volumes had appeared, crowded with important papers. The appearance of the fourth volume is connected with one of the most serious blows received by the academy. This volume was published by Dr. George J. Engelmann as a memorial volume to his father. George Engelmann, who had been with the academy from its start, one of the founders of the old Western Academy in 1836, died in February, 1884.

George Engelmann is a name which will live long in the annals of American science. A native of Germany, he was born at Frankfort-on-the-Main, February 2, 1809, and was the oldest of a family of thirteen children. In 1827 he held a scholarship at Heidelberg; in 1830 he was at the University of Berlin, and in 1831 he graduated, an M. D., at Würzburg. His dissertation was upon Plant Teratology; it possessed unusual merit, and attracted wide attention among the masters in the subject. In 1832 he was at Paris for medical study, but in the fall of that year sailed for this country to serve as agent for friends looking to investment in America. At that time the Mississippi Valley was truly frontier. Dr. Engelmann tarried for a time in Illinois, then traveled in Arkansas and adjacent districts, but finally, in 1835, settled at St. Louis to practice medicine

After four years he left his practice with Dr. Wislizenus, and went to Germany to marry Miss Dora Horstmann, to whom he had been engaged for ten years. The following year, in 1840, Dr. and Mrs. Engelmann came to St. Louis. We have already mentioned Dr. Engelmann's interest in the Western Academy of Science in 1836–'37. It was in 1835 that he began the remarkable series of meteorological investigations and records which were kept up continuously for nearly fifty years. In 1842 he published his important monograph upon American *Cuscutinæ* in the American Journal of Science and Art. The paper caused a true sensation in botanical circles. In 1848 he prepared the report upon the *Cactaceæ* of Doniphan's Rio Grande and Mexican trip, and later the important reports upon the *Cacti* of the Pacific Railroad survey and the Mexican boundary. These papers, the standard authority upon this interesting and important family of plants, are a monument of accurate and careful work. Dr. Engelmann was a considerable traveler. He made many journeys to the West and South, and to Europe, always to the profit of botanical science. There existed between him and Asa Gray and Charles C. Parry the kindest sympathy and deepest regard. On many of his journeys Mrs. Engelmann was his companion. Between the two there existed the most delightful companionship and love. Early in 1879 she died, and it might almost be said that he was never happy again. In vain his friends attempted to cheer him. A trip to the Pacific coast in company with C. S. Sargent and C. C. Parry was arranged, but it failed to relieve his depression or to cure his bodily ills. In the summer of 1883 he went again to Germany, but broke down upon the trip and died soon after his return home. It is significant of the man's interest in his work that, while he was ready to go, he longed to live just one year more, that he might finish out his half century of meteorological observations. During his later years, Dr. Engelmann was in the habit of preparing summaries of the observations for each year, making careful comparisons with the records of preceding years, computing averages, drawing diagrams, etc., for presentation at the academy. Dr. Engelmann's interest in the academy never flagged; one of its founders in 1856, he was rarely absent from any meeting if he was in the city; he served as president sixteen times. Though having many opportunities to publish his botanical notes, he loyally preferred the medium of the Transactions of the academy he so much loved and for which he did so much. The bulk of his literary production is scattered through its pages. There are his papers upon cacti, Rocky Mountain pines, North American juncus, yucca, junipers, firs, agave, oaks, isoetes, the genus Pinus, etc.—papers that rank among the best in American botany. Yet all this work was done, not by a

professional botanist, but in the leisure hours of a very busy physician's life. In these days, when there is some tendency to sneer at "amateur scientists," it is well to remember the work of men like George Engelmann.

To completely understand the work of the St. Louis Academy of Science to-day, something must be known of two other institutions—the Washington University and the Missouri Botanical Garden. The three institutions are closely related in their *personnel* and in their work. The reason for their mention at this point is that the garden is largely due to George Engelmann. Henry Shaw was a wealthy business man of St. Louis; he lived in the city, but had a country home and a great property in land outside of the then city limits. Mr. Shaw enjoyed country life and developed a garden, which even then was an attractive place of resort. A friend of Engelmann, the latter was able to direct the rich man's taste into profitable channels; the result was that Shaw's Garden was really a botanical garden. From it has grown an institution of the greatest importance and interest—the Missouri Botanical Garden. It is organized in accordance with the terms of Mr. Shaw's will. The garden proper consists of several acres, upon which stand the old country home now used as the residence of the director, and the former city house of Henry Shaw, which was in accordance with the terms of the will removed from its former site and rebuilt exactly, and which is now used as an office. In this latter building is the botanical library—one of the best in America; two particularly interesting sections of it are the pre-Linnæan and the Linnæan libraries. Here, too, is the Engelmann herbarium, containing rich series of important type specimens. This valuable donation to the garden was made by Dr. George J. Engelmann, son of the botanist. A graceful thing done by Mr. Shaw shortly after Engelmann's death was the republication, in one quarto volume of 508 pages and 103 full-page plates, of all of Dr. Engelmann's published botanical work. The garden also has now in its possession the Engelmann library and all the original notes and botanical sketches made by Dr. Engelmann. The mass of these notes is enormous. Dr. Trelease, to whose care they are intrusted, found twenty thousand slips which, bound up, composed sixty quarto volumes. The garden includes among its features an arboretum of the first grade, greenhouses where experimental work is conducted, experimental gardens for fruits and vegetables, and a Bible garden. This last, an idea carried out in Mr. Shaw's lifetime and still maintained, aims to illustrate the plants mentioned in the Bible. An excellent feature in the work of the garden is the training school for practical gardeners. Six young men are here on scholarships, following a definite course of study; they live upon the place and re-

ceive free tuition, rent, and board; their appointment is by competitive examination. Prof. William Trelease is the director of the Missouri Botanical Garden, and has an able corps of scientific and office assistants and gardeners.

An important part of Mr. Shaw's plan was the establishment of a school of botany, the head of which was to hold the George Engelmann professorship. This school is organized in connection with Washington University; it is closely related to the Missouri Botanical Garden, the directorship of which is also held by the occupant of the chair. In the work of the school Professor Trelease has three assistants; seventeen different courses of instruction are offered by them. Under the direction of the school there are also offered at the garden important courses in elementary botany for children or for busy people.

Washington University is in close touch with the Academy of Science. From its faculty come some of the academy's most active workers and officers. Professors Woodward (mathematics and mechanics), Nipher (physics), Engler (mathematics), Pritchett (astronomy), Trelease (botany), and Hambach (geology) have been conspicuous in its work. To the Transactions of later years they have contributed numerous and important papers. At a time when the academy had no other home, the doors of the university were opened to it for its meetings and the housing of its library and the storing of its collection. The academy is fortunate, indeed, in having been so closely in sympathy with an institution of learning the interest of whose teaching force more than aught else kept it active during a critical period of its history.

Among the most active members who came to recruit the force, which we have seen above from Dr. Engelmann's statement had been somewhat reduced by time, was that master worker in entomology, Dr. Charles Valentine Riley. Born in London, England, on September 18, 1843, he was schooled at Chelsea and Bayswater, at Dieppe, France, and at Bonn, Germany. In 1860 he came to this country, settling upon a farm in Illinois. Removing to Chicago, he began editorial work upon the Evening Journal and the Prairie Farmer. Near the close of the war, May, 1864, he joined the 134th Illinois Volunteers. When the war ended he resumed his editorial labors on the Prairie Farmer. In 1868 he was appointed State Entomologist of Missouri, a position which he ably filled until 1877, when he was made chief of the commission appointed by the United States Government to investigate the ravages and life history of the Rocky Mountain locust. The greater part of the reports of this commission was written by him. In 1881, when the commission was merged into the work of the Agricultural Department, Dr.

Riley organized the entomological division of the department, and became its head. At the same time he became curator in entomology of the United States National Museum, to which he donated his magnificent private collection of insects, containing more than fifteen thousand specimens. Dr. Riley at different times lectured upon entomology at various institutions—Cornell University, Missouri State University, Washington University, etc. He was a diligent writer. A man of energy and decision, he was also of most amiable character, and was much loved by his friends and colleagues. The honorary degree of Ph. D. was granted to him in 1873 by Washington University. The French Government, in 1873, and the Edinburgh Forestry Exhibit, in 1884, conferred upon him gold medals in recognition of his work.

In 1835 there came to St. Clair County, Illinois, a talented German, Theodore Erasmus Hilgard. A lawyer by training, he there settled down to country life. He introduced the culture of the vine into Illinois. The town of West Belleville was laid out upon his property and under his direction. He delighted in himself conducting the education of his family, and his three sons, Julius Erasmus, Theodore Charles, and Eugene Waldemar, all attained prominence in American science. In 1851 he returned to his native land by invitation of the Bavarian Government to aid in recasting the national laws regarding mortgages. Although he again visited this country, he did not remain here, but finally settled at Heidelberg, where he died in 1873. He was a poet and a man of letters. His second son, Theodore Charles Hilgard, was prominent in the academy's work for many years. He was born in Zweibrücken, Germany, February 28, 1828. While a young man in his Illinois home he collected botanical specimens for George Engelmann. Later, he studied medicine in European schools—Heidelberg, Zurich, Vienna, Berlin—and settled down to practice in St. Louis. In 1854 he published his Experimental Observations on Taste and Smell. At various times he presented papers on botany—especially on *Phyllotaxis* and kindred subjects—before the academy. These were printed in the Transactions. Obliged on account of failing health to abandon medicine, his studies were turned to microscopic forms of life and to terrestrial magnetism; in the latter subject he assisted his brother Julius, to whom it was professional work. He died in New York, March 5, 1875.

For two years James Buchanan Eads was president of the academy, and was associated with it for a much longer period. No member of the academy has had a more conspicuous career. It was "he who devised and furnished our Government with its first and most useful armored steamboats, who built the St. Louis Bridge; who

made one of the shallowest mouths of the Mississippi permanently navigable for ocean steamers." The story of his life reads like a romance. Born at Lawrenceburg, Indiana, May 23, 1820, he was even as a small child passionately fond of machinery. The family moved to Louisville when he was nine years old. At ten years he was busy making models of all sorts of machines—sawmills, fire engines, steamboats, and steam engines. Financial reverses forced him to take care of himself at the age of thirteen. At that time the family moved to St. Louis, and, curiously, the steamboat on which they were traveling burning, the boy found himself on shore, barefooted and coatless, upon the very spot where later he was to locate the abutements of the great and famous bridge. For a time he sold apples on the street. Then, securing a position in a mercantile house, he labored diligently, reading in his leisure hours books borrowed from the library of one of his employers. In 1839 he was purser on a river steamer. In 1842 he invented a diving-bell boat to recover cargoes from lost steamers, and later a boat to raise sunken steamers. In 1845 he sold out his interest in this business, and started a glass factory, which completely failed in two years. Helped by his creditors to a small capital, he returned to the work of raising wrecked steamers, and in ten years he was out of debt and had business interests worth five hundred thousand dollars. In 1861 there began those great public enterprises which rendered his name famous the world around. At the request of the Government he designed and constructed a squadron of ironclad river gunboats. The next year he built others, some of which bore turrets of novel pattern, in which the guns were worked by steam. In 1874 he completed the St. Louis Bridge, a marvel of engineering, in the building of which several new problems had to be solved. Later on, in the face of doubt and lack of confidence, he devised and carried on to successful completion the jetty system at the mouth of the Mississippi. Had his ideas with reference to the improvement of the river farther up been carried out, there would be

JAMES B. EADS, LL. D.

fewer bursting levees to-day. The great engineer died March 8, 1887.

Dr. Engelmann's meteorological investigations were of the utmost importance, and are fully recorded in the Transactions. He was not, however, the only worker along this line. Dr. Wislizenus was devoted to the same subject. Among his observations was an extended series upon atmospheric electricity. While his work did not lead to that practical application which he had hoped, the record of his experiments is interesting and valuable. Under Prof. Francis E. Nipher there was organized the Missouri State Weather Service, one of the most creditable State organizations ever established. As long as the direction of this service remained local, Professor Nipher was in charge. The scope of the service included the whole State, and the plan involved the appointment of one observer for each county. Work was begun in December, 1878. Some of the results of this State weather service were contributed to the academy and published in its Transactions. Thus, in 1888, there appeared a summary of the results of ten years of labor, including important rainfall maps. Even more important was the Magnetic Survey of the State undertaken by Professor Nipher, and carried on almost wholly at his own expense. The annual reports of this survey regularly appeared in the Transactions.

A. WISLIZENUS.

Dr. Frederick Adolphus Wislizenus, whose name has so frequently been mentioned in this sketch, was born May, 1810, at Koenigsee, in Schwarzburg-Rudolstadt, the son of a Protestant minister who was perhaps of Polish descent. In 1828 young Wislizenus began the study of medicine at Jena, pursuing the work at Göttingen and Würzburg. On account of political difficulties he was obliged to go to Switzerland to finish his education, and in 1834 graduated from the University of Zurich. In 1835 he removed to New York to practice his profession. He was there at once a physician, political pamphleteer, and poet. In 1837, with certain friends

who had been exiled from their own land, he removed to Illinois, practicing at Mascoutah for a time, but finally removed to St. Louis. In 1839 he went into the far Northwest on a fur-trading expedition. While there he spent some time among the Nez Percés Indians. In 1840 he began practice in St. Louis, where his influence among the German population, both politically and otherwise, was great. Some time later he joined a Mexican trading expedition, taking with him a good scientific equipment; he was, however, seized and imprisoned at Chihuahua, and was only liberated on the arrival of Colonel Doniphan's troops there in 1847. He remained with those forces in a professional capacity until they were disbanded in the summer of 1847, when he returned to St. Louis. The next year an official report of the scientific results of this journey appeared at Washington; it was entitled Memoir of a Tour to Northern Mexico, and contains geographical, geological, topographical, astronomical, and barometric observations. He brought home many plants, which were afterward worked out by Engelmann. While in Washington, Wislizenus met Miss Lucy Crane, sister-in-law of Hon. George P. Marsh. In 1849 a cholera epidemic raged at St. Louis, throughout which Dr. Wislizenus labored at his profession. Meantime Mr. Marsh had been appointed minister from the United States to Turkey. In 1850 Wislizenus went there, and at Constantinople was married to Miss Crane. They visited various parts of Europe, and on returning to this country, Dr. Wislizenus, leaving his wife in the East, went himself to Panama, with some idea of settling there. In 1852, however, he returned to this country, and settled permanently in St. Louis. He was one of the founders of the academy, and an honored member of various medical societies. His barometic observations and his collections in botany and mineralogy were of value. While Dr. Engelmann was absent in Europe, in 1858, Wislizenus took charge of his observations, becoming so interested that he afterward continued them for himself until 1881, when failing eyesight interfered with the work. He died September 22, 1889.

There are to-day few, indeed, of the original members of the academy alive. Mr. C. P. Chouteau and Nathaniel Holmes are all. Through a large part of its history Mr. Holmes was the secretary of the academy; not himself a professional scientist nor a large contributor to any definite line, he was a man of wide reading and varied interests. He carefully examined everything that came to the society's library through the long period of his secretaryship, and it was his practice to prepare careful papers upon what he read, papers which added much to the interest of the meetings, and often led to important discussions. While Mr. Holmes is not now a resident of

St. Louis—living in the East—his interest in the academy continues. The only other member approaching these pioneers in the length of connection with the academy is Dr. Enno Sander. Dr. Sander's membership dates from the first year of its organization, 1856. For the past thirty-five years he has been the faithful treasurer of

NATHANIEL HOLMES.

DR. ENNO SANDER.

the academy, and at a recent meeting his friends presented to the society an oil portrait of him in commemoration of the completion of so long and careful a service.

The publications of the academy have not been wholly confined to the Transactions. On two occasions special works have appeared under its imprint. First of these is an archæological report by W. D. Potter and Edward Evers. A party from the academy made considerable investigation of mounds in the neighborhood of New Madrid in the southeast corner of the State. The collections were divided for study into three groups. W. D. Potter was to study the pottery, G. J. Engelmann the other relics, chiefly of stone, while Dr. Evers was to report upon the human remains. A quarto volume of thirty pages with twenty-four fine plates, entitled Contributions to the Archæology of Missouri, by the Archæological Section of the St. Louis Academy of Science, was printed. It is devoted to description and illustration of the pottery. So far as we can find, Dr. Engelmann did nothing upon his part of the work. Dr. Evers began his report upon the twenty-seven crania which were

found, but has never completed it. It is much to be regretted that this important work has not been finished. In 1889 the academy sent observers into the field to study the total eclipse of that year. The party consisted of Professors Pritchett, Nipher, Engler, Mr. Charoppin, and Signor Valle. Their report was entitled *Total Eclipse of the Sun, January, 1889. A Report of Observations made by the Washington University Eclipse Party at Norman, California.* The report was published by the academy, and is a quarto of thirty-nine pages, with six plates.

The present form of publication of the Transactions is convenient, and secures prompt dating of the papers read. Important papers are printed, soon after reading, as *brochures* in separate covers. When a sufficient number of these to form a volume has been issued the official minutes of meetings and an index are also issued, and the volume is closed. To give an adequate idea of the range and value of the recent papers printed by the academy would be impossible in this article. But few can even be mentioned. Pritchard, Engler, and Nipher have repeatedly printed articles of great importance in mathematics, astronomy, and physics. A series of most interesting papers upon the relations between plants and insects, and other botanical subjects, has emanated from Dr. Trelease's work in the Shaw School of Botany. The indefatigable librarian, Dr. G. Hambach, who probably knows more of the details of the academy's history than any other man now living, has contributed valuable papers, beautifully illustrated with his own drawings, upon fossil echinoderms. Among other papers by Dr. Woodward are some dealing with points of curious interest to the teacher and the anthropologist. In pure anthropology, Dr. W. T. Porter's three papers upon St. Louis school children—Physical Basis of Precocity and Dullness, Growth of St. Louis School Children, and Relations between Growth of Children and their Deviation from the Physical Type of their Sex and Age—are almost likely to be classical.

After this brief historical sketch it will be well, in closing, to summarily state the present condition of the academy. Two hundred and eight active members are at present on the list, paying annual dues of five dollars each. There are two hundred and four corresponding members. The library contains twelve thousand books and eight thousand pamphlets; it is open certain hours daily. Six volumes of Transactions aggregating 4,539 pages, and twelve *brochures* of Volume VII aggregating 298 pages, have been printed to date. Other publications as above specified have been issued. The exchange list includes 550 scientific institutions. The academy has six thousand dollars of permanent fund, one thousand of which came by bequest from Henry Shaw, one thousand from savings, and

the balance from the Lucas lot. Regular meetings are held twice monthly. At present it has no displayed collections and no quarters of its own. Surely it should move toward securing these in the near future, as also toward making itself more directly and strongly felt in the life of the city at large.*

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* List of presidents and secretaries.

1856.	George Engelmann	B. F. Shumard.
1857.	B. F. Shumard	Nathaniel Holmes.
1858.	F. A. Wislizenus	" "
1859.	" "	" "
1860.	Hiram A. Prout	" "
1861.	George Engelmann	" "
1862.	" "	" "
1863.	" "	" "
1864.	" "	" "
1865.	" "	" "
1866.	" "	B. F. Shumard.
1867.	" "	" "
1868.	B. F. Shumard	Nathaniel Holmes; Charles E. Briggs.
1869.	" "	Charles E. Briggs.
1870.	George Engelmann	" "
1871.	John B. Johnson	Samuel Reber.
1872.	James B. Eads	William T. Harris.
1873.	" "	Nathaniel Holmes.
1874.	William T. Harris	" "
1875.	" "	" "
1876.	Charles V. Riley	" "
1877.	" "	" "
1878.	George Engelmann	" "
1879.	" "	" "
1880.	" "	" "
1881.	" "	" "
1882.	" "	" "
1883.	" "	Henry S. Pritchett.
1884.	" "	" "
1885.	Francis E. Nipher	E. Evers.
1886.	" "	" "
1887.	" "	" "
1888.	" "	" "
1889.	" "	" "
1890.	" "	" "
1891.	" "	E. A. Engler.
1892.	Henry S. Pritchett	Arthur Thatcher.
1893.	" "	" "
1894.	" "	A. W. Douglass.
1895.	John Green	W. Trelease.
1896.	M. L. Gray	" "
1897.	" "	" "

PRINCIPLES OF TAXATION.

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XVI.—TAXATION OF CHOSES IN ACTION.

IN addition to the review of the celebrated Foreign-held Bond Case (see Popular Science Monthly, vol. lii, No. 3, pages 354–373), decided by the United States Supreme Court in 1893, it is proposed to call attention here to additional and interesting features of this case which have not been hitherto noticed in this connection.

The court having decided the *situs* for taxation of negotiable instruments—railroad bonds, etc.—took occasion also to affirm the taxable *situs* of such other personal property, or evidence of indebtedness, as is generally included under the term of *choses in action*, using in so doing the following language:

"But other personal property, consisting of bonds, mortgages, and debts generally, has no *situs* independent of the domicile of the owner, and certainly can have none where the instruments, constituting the evidence of debt, are not separated from the possession of the owner."

As thus expressed, the reasons given by the court for separating for taxation the *situs* of the two classes of personal property under consideration are so clear, and so in accordance with common sense, as hardly to require any further explanation; and, therefore, it seems only necessary to assist the reader, who, if a taxpayer, is certainly interested in knowing the tax liability of his property, by recalling that while, in the case of negotiable instruments, the title to the property runs with the instrument and passes by delivery, in the case of bonds, mortgages, and sales made to particular persons, and thus non-negotiable, the title, on the other hand, does not run with the instrument, but exclusively with the person of the owner; so much so, that the attachment of a mortgage, or the possession by theft or finding of a note payable to a person, does not in any degree alienate or impair its original and legitimate ownership. The decision of the court, therefore, brings all classes of personal property under one harmonious and consistent rule for the purpose of taxation, legal attachment, and protection, by affirming that their *situs* as property is only where they are; which in the case of visible and tangible objects and negotiable instruments, is dependent, from the very nature of things, upon actual and not constructive presence, and in the case of *choses in action* upon the domicile of the owner;

and in thus deciding, the court simply followed English precedents of long standing and the highest character.*

It may, however, be objected that the practical effect of this decision has been to relieve all negotiable instruments from taxation, inasmuch as, removed beyond the territory and jurisdiction of the State in which their owner resides, they will not, by reason of easy concealment (for which safe-deposit companies in the larger cities of most of the States now offer great facilities), be easily cognizable by the assessors of the locality in which they are deposited. But admitting the objection in full force, as in all reason we must, what then? The Supreme Court has given its opinion clearly and unmistakably; and until this opinion is reversed, it constitutes the legitimate rule of action for both assessors and taxpayers. But suppose it were possible to reverse the opinion in question, would it be expedient to do so? Would it be desirable to abandon the plain common-sense view that the *situs* for the taxation of all personal property is where the law protects it, and where alone an assessment and a legal attachment against it can be enforced, and in its place make *situs* depend on visibility? And if visibility, what degree of visibility? Shall a diamond, a bar of gold, or a railroad bond, belonging to A. B., residing in Boston, but openly displayed in a jeweler's or broker's window in Philadelphia, be taxable in Pennsylvania, and a similar diamond, gold bar, or bond of the same owner, deposited in a drawer of the same shop or office and not so readily visible, be taxable in Massachusetts? Shall we make the *situs* of property for taxation depend upon the keenness of perception or visual organs of an assessor? Or shall we not rather, admit that the attempt to raise revenue by taxing such property as negotiable instruments which from their very nature are in a high degree intangible and invisible, and thus easy of concealment; which, passing by delivery, are here to-day and somewhere else to-morrow; which are not taxed in any other highly civilized country, and which are in great part, even in this country, specifically exempted by law—i. e., United States bonds, legal tender, national bank notes, etc.—is in itself an absurdity and a wrong; inasmuch as to enforce a levy from one man for one species of property, because through his honesty, ignorance, or inability to escape he can be laid hold of, and allow identically the same description of

* Lord Ellenborough, in King's Bench (Neilage *vs.* Holloway, Barnwell and Allison's Reports, 318), having decided that a negotiable note was a chattel personal and not a chose in action; Lord Abinger, that all foreign government bonds payable to bearer have a *situs* where they are actually situated; and the House of Lords, that registered stocks and bonds of the United States and of the several States not passing by delivery, are not negotiable instruments, and therefore not taxable as goods and chattels.

property in the possession of another man to escape because of varying circumstances beyond the control of the assessors, is not taxation in any sense, but simply arbitrary taking. The court itself, in referring to the tax under consideration, said with great point and truth: "*It is only one of many cases where, under the name of taxation, an oppressive exaction is made, without constitutional warrant, amounting to little else than an arbitrary seizure of private property. It is, in fact, a forced contribution levied upon property held in other States, where it is subjected, or may be subjected to taxation upon an estimate of its full value.*"

DECISION OF THE SUPREME COURT OF CALIFORNIA ON THE TAXATION OF MORTGAGES.—Any review of the history of local taxation in the United States would be imperfect which failed to notice a notable and interesting decision given in May, 1873, by the Supreme Court of California in regard to the taxation by its State authorities of real-estate mortgages. The question was one that for a considerable time had greatly interested the people of California, and the drift of popular sentiment of San Francisco seems to have been most unmistakably in favor of their taxation. But how to do it, and at the same time not increase the burden on the borrower, who had mortgaged his land as security for a loan of capital to improve or stock it, was a problem that not a little troubled the lawmakers in Legislature assembled. One proposition brought forward contemplated a deduction from the amount of land tax of the assessment on the mortgage; but as the lands of California were found, as a rule, to be taxed far below their value, and the mortgages for a value far in excess of the assessor's appraisement of the land they covered, it became soon apparent that this scheme was to a greater or less extent equivalent to exempting the land and taxing the mortgage. Another proposition, embodied in a bill introduced into the Assembly, was to make void all contracts by which borrowers agreed to reimburse lenders in the amount of the mortgage tax; while others again were exceedingly strenuous in favor of trying the pleasing little experiment—which no community having once tried ever desires to repeat—of providing that the person giving the mortgage should pay the taxes upon it, but be at the same time authorized to deduct the tax from the principal, or interest, in settling with his creditor. Pending these discussions, however, the Supreme Court, which had the question before it on a suit to which one of the savings banks of San Francisco was a party, rendered a decision, that in virtue of a clause in the Constitution of the State requiring all taxation to be equal and uniform, the taxation of mortgages was unconstitutional and illegal; inasmuch as to tax a given property and then tax a mortgage on it, which mortgage is

not in itself property, but, like a deed or lease, is a species of conveyance or acknowledgment of a conditional interest or right in the property, is not equal and uniform taxation, but an unequal and double tax on the property mortgaged.

The importance of this decision, considered as an act reformatory of the popular theory of local taxation, does not require to be proved and illustrated; but as it was unquestionably a step in advance of any heretofore taken by either our Federal or State courts, and as, by reason of it, not only were mortgages exempted from taxation in California, but also all promissory notes and other evidences of indebtedness, it is desirable briefly to ask attention to the reasoning by which the court was led to its conclusions.

The opinion was given by the Chief Justice—Crockett—who, after reviewing the history of the case, is reported to have used the following language:

"I come now to the point, whether a tax on land at its full value, and a tax on a debt for money loaned, secured by a mortgage on the land, is in substance and legal effect a tax on the same property. We all know, as a matter of general notoriety, that almost universally, by a stipulation between parties, the mortgagor is obliged to pay the tax both on the land and on the mortgage. Practically he is twice taxed on the same value, if he has still in his possession the borrowed money to secure which the mortgage was made. The law taxes in his hand both money and land; and by his stipulation he is required to pay tax on the mortgage debt, and also, if the money has pased out of his hands into the possession of some other taxpayer, it is taxed in the hands of the latter, so that the money bears its share of taxation, and the land its share, in the hands of whomsoever they may happen to be.

"It is very true that a voluntary agreement on the part of the mortgagor to pay the tax on the mortgage debt can not improve its *situs*. The State was no party to the contract, and is not bound by stipulation *inter alias*. The burdens of taxation can not be shifted from those on whom the law imposes them by stipulations between private persons; but in the absence of such a stipulation, an inexorable law of political economy would impose upon the mortgagor the burden, in a different form, of paying the tax on the mortgage debt. Interest on money loaned is paid as a compensation for the use of the money, and a rate of interest as agreed on is the amount which the parties stipulate will be the just equivalent to the lender. If, however, by the imposition of a tax on the debt, the Government diminishes the profit which the lender would otherwise receive, the rate of interest will be sufficiently increased to cover the tax, which in this way will be ultimately paid by the borrower.

The transaction would be governed by the same immutable, inflexible law of trade by reason of which import duties on articles for consumption are ultimately paid by the consumer, and not by the importer. The rate of interest on money loaned is regulated by the supply and demand which govern all articles of commerce; and the burdens imposed by law in the form of a tax on the transaction, which would thereby diminish the profits of the lender, if paid by him, will prompt him to compensate for the loss by increasing to that extent the rate of interest demanded. *If his money would command a given rate of interest without the burden, he will be vigilant to see that the borrower assumes the burden, either by express stipulation, or in the form of increased interest. This is the law of human nature, which statute laws are powerless to suppress, and which pervades the whole of trade governed by the law of supply and demand.* Nor would the enactment of the most stringent usury laws produce a different practical result. Human ingenuity has hitherto proved inadequate to the task of devising usury laws which were incapable of easy evasion; and wherever they exist they are, and will continue to be, subordinate to that higher law of trade which ordains that money, like other articles of commercial value, will command just what it is worth in the market, no more and no less. Assuming these premises to be correct, and I am convinced that they are, it results that it is the borrower, and not the lender, who pays the tax on borrowed money, whether secured by mortgage or not; but if secured by mortgage, he is taxed not only on the mortgage and property, but on the debt which the property represents and which is held as a security for the debt." *

Subsequently the Hibernia Savings Society of San Francisco having resisted under the provisions of the Constitution of California the taxation of mortgages given to secure the loan of property, the Supreme Court again met the case fairly and squarely—its language by Justice Wallace being reported as follows: "Mere

* Of the soundness of this decision there could probably be no more convincing illustration than the statement that upon its announcement the savings banks of San Francisco gave notice that they would immediately reduce the rate of interest on their loans secured by mortgages by the amount of the tax on the mortgage. And the Alta-California of May 9th, in commenting upon the decision, says: "When the news arrived here yesterday morning" (that the Supreme Court had given a decision) "it was not unexpected; and the idea conveyed by the false rumors set afloat, that the decision was adverse to the savings banks, was accepted as a decision measured by expediency, and not based on sound legal principles. Special dispatches received changed the result; and when it became evident that the banks and the mercantile community had triumphed, a general feeling of satisfaction was everywhere noticeable. Merchants, bankers, and taxpayers generally received the news with the feelings of men who felt relieved from a terrible incubus."

credits are a false quantity in ascertaining the sum of wealth which is subject to taxation as property, and so far as that sum is attempted to be increased by the addition of these credits, property based thereon is not only merely fanciful, but necessarily the imposition of an additional tax upon a portion of the property already once taxed. The taxation thus imposed, nominally upon credits, having resulted in the double taxation of money, the additional tax must be paid by some one. And here all experience, as well as all settled theories of finance, concur that it is not the lender who pays, but the borrower. The borrower is the consumer; the interest that he pays to the lender is the prime cost of the delay for which he has contracted. If the Government, by the imposition of additional taxes, increase the cost, the borrower, being the consumer, must pay for it."

The court, through Justice McKinstry (the Chief Justice's opinion being in concurrence), enumerated, as follows, some of the absurdities to which an attempt to include *choses in action* in the definition of property would necessarily lead:

"Supposing," he said, "that the necessities of Government required a tax of one hundred per cent on all values, or, what would be the result of such a tax, an appropriation of all the property in the State—it is plain that the State would receive no benefit from evidences of debt due by some of her citizens to others, and payable out of the tangible property which the State had already taken.

"The Legislature may declare that a cause of action shall be taxed, but a cause in action can not pay the tax; and this because it has, and can have, no value independent of the tangible wealth out of which it may be satisfied.

"It may be possible in every case to show that the debtor has paid the tax assessed to his creditor. But it admits of mathematical demonstration—if other property in the State has been assessed at its value—that the money which shall ultimately satisfy the debt (if it ever is satisfied) has paid the tax. If it were practical to assess all the property in the State at the same moment of time, it would be clear to every mind that an assessment of a credit was an attempt to transfer to it a value elsewhere assessed. If a debtor was found to be the owner of one thousand dollars, and is assessed for that sum, and his creditor is found to be the owner of his note for one thousand dollars, and is assessed for a like sum; and if the day after the visit of the assessor to the creditor the debtor shall pay his note, it is clear that this same value has been twice taxed; since the debtor has parted with his money, and received only that which is certainly not taxable property in his hands, and which can never afterward be assessed. When a debtor pays his debt,

he does not abstract or destroy any portion of the taxable property of the State; the aggregate of values remains the same."—*Opinion of Justice McKinstry.*

Suppose, "were such a thing possible, that the entire tax rolls exhibited nothing but indebtedness. Taxation under such circumstances would, of course, be wholly fanciful, as having no actual basis for its exercise."—*Opinion of Chief-Justice Wallace.*

AN APOSTATE DEMOCRACY.

By FRANKLIN SMITH.

WERE the founders of the American Republic to return to the scene of their memorable achievements, that which would surprise them most would not be the railroad or telegraph; it would be the change in the principles and practice of government that has taken place since their day. I do not mean to say that the marvelous discoveries of science would not arrest their attention. By no means were they without appreciation of the things that make for industrial progress. But to them the thing of most importance in the affairs of life was government. They felt that all was lacking where a people lacked the guarantee of freedom and justice. Where these were had, all else was possible. Sooner or later it would come as the triumph of individual thought and effort. Not so now. The government that insures freedom and justice, leaving the citizen to work out his own destiny, moral and industrial, is not the ideal of the statesman and philanthropist of to-day. Reverting to the ideal of feudalism, one that took the Anglo-Saxon four centuries to get away from, they conceive the government to be best that governs most. But in the eyes of the founders of the republic such a government was intolerable; for it was to escape despotism that they fought the Revolution.

These patriots were under as little delusion about the nature of democracy as a political power as they were about the nature of autocracy. What the history of the ancient and mediæval republics had taught them of its capacity for corruption and despotism their own experience had in no way tended to revise and correct. It had accepted bribes; it had exercised a religious intolerance that rivaled the Inquisition; it had sought to fill its exchequer by means as repugnant to honesty and freedom as those of any Valois despot. As ardent a democrat as Jefferson had no more taste for the tyranny of the majority than for any other tyranny. Upon his first inauguration, he seized the occasion to warn his countrymen

against it. "All . . . will bear in mind this sacred principle," he said, proclaiming a truth more honored in the breach than in the observance, "that though the will of the majority is in all cases to prevail, that will, to be rightful, must be reasonable; that the minority possess their equal rights which equal laws must protect, and to violate which would be oppression." Madison, too, rejected the popular superstition that the government of the majority must be synonymous with wisdom and justice. "Wherever the real power in a government lies," he wrote, "there is danger of oppression. In our government, the real power lies in the government of the majority of the community, and the invasion of private rights is chiefly to be apprehended, not from acts of the government contrary to the sense of the constituents, but from acts in which the government is a mere instrument of the major number of constituents. This is a truth of great importance," he added, disclosing a state of the popular mind that the experience of a century has not bettered, "but not sufficiently attended to." As is well known to the students of American history, the Federalists, who now take high rank among the saints of democracy, were even more distrustful of it than Jefferson and Madison. "General Hamilton," says Morris, presenting that statesman in a light that must make his socialistic worshipers feel that they have been burning incense to a false god, "hated republican government because he confronted it with democratical government, and he disliked the latter because he believed that it must end in despotism and be in the meantime destructive to the public morality." * The vehement indictment of bluff old John Adams is worthy of Carlyle himself. "If," he writes, "you give more than a share in the sovereignty to the democrats—that is, if you give them the command or preponderance in the sovereignty, that is, the legislature—they will vote all the property out of the hands of you aristocrats, and if they let you escape with your lives, it will be more humanity, consideration, and generosity than any triumphant democracy ever displayed since creation." †

Men possessed of such views of democracy as a political power were not likely to frame a government based upon the deification of the majority. Never having steeped themselves in the mysticism of political romance and speculation, they did not dream that the state could be wiser and more virtuous than the people that composed it. Nor could they think of it as a beneficent power, exhaustless in expedient and resource, that could, like a fairy, turn their footsteps from every pitfall and, by the wave of a wand, shower upon them all the blessings of existence. What they conceived it to be was

* Van Buren. Political Parties in the United States, p 80.

† Works, vol. vi, p. 516.

more in touch with reality—a voluntary association of citizens with equal rights. What they expected of it was not so transcendent of the limits of the possible—protection in the enjoyment of those rights. In the Declaration of Independence, so much sneered at and yet so deeply rooted in the truths of social science, they announced that all men were "endowed by their Creator with certain unalienable rights; that among these are life, liberty, and the pursuit of happiness; that to secure these rights, governments are instituted, . . . deriving their just powers from the consent of the governed." "All men," said one of the Bills of Rights to be found in the State Constitutions that followed in the wake of the Declaration, "are by nature equally free and independent, and have certain inherent rights, of which, when they enter into a state of society, they can not by any compact deprive or divest their posterity—namely, the enjoyment of life and liberty, with the means of acquiring and possessing property, and of pursuing and obtaining happiness and safety." * No state socialism here; no feudal regulation of industry or morals: only devotion to a freedom, indispensable to happiness and social development, and a demand for its protection.

Upon the meeting of the convention called to frame a government for the territory wrested from British despotism, there was no purpose in the minds of the delegates more distinct than to insure this protection. Indeed, it was paramount; it dominated every other thought. To "establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity"—such is the simple but noble and adequate motive they ascribed to themselves, a motive hitherto absent from the world of political thought and action. As if apprehensive that these patriots and statesmen had not been sufficiently explicit to guard against despotism, as odious in the government of the many as of the one, the people demanded the amendment that no person shall "be deprived of life, liberty, or property without due process of law; nor shall private property be taken for public use without just compensation." Later, the apprehension still existing that the provision made to "secure the blessings of liberty to ourselves and our posterity" was still imperfect, another amendment was added. "No State," it says, putting a restraint upon a despot that has exercised a power far more destructive of freedom than that feared by the fiercest opponent of the Federal Government, "shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States, nor shall any State deprive any person of life, liberty, or property

* Virginia Constitution of 1776.

without due process of law, nor deny to any person within its jurisdiction the equal protection of the laws." Of the pressing need of this restraint, no better proof is to be had than the mass of litigation involving it that has come before the courts since its adoption.

But liberty and justice, the sole warrant of any community to the title of a free democracy, are not born of a constitution, however ingeniously provided with checks and balances or devoutly worshiped in leader and speech. Hardly had the new Government been launched before there was another of the countless demonstrations that the wisest resolution is no certain bar to the greatest folly —that boast as the political quack may of the efficacy of his machinery, it has neither potency nor virtue beyond the people that work it. Despite the sacredness of the Constitution, so piously worshiped by the party in power, it was remorselessly wrenched to add Louisiana to the Federal domain. With like disregard of its inviolable principles of freedom, the alien and sedition laws were passed in a time of peace; and without the excuse of war, the embargo was established. Under the Nemesis of political intrigue, the electoral provisions of the new *Magna Charta* were permitted to lapse without a twinge of remorse. Long before the republic, so solemnly ordained "to establish justice" and to "promote the general welfare," had passed the first half century of its existence, its citizens had discovered how it could be converted into a powerful instrument of private greed. The tariffs of 1816, 1824, and 1828 were progressive applications of the ethics of the robber barons. The American spoils system, an institution sacred to the memory of the most democratic of democrats, was only a metamorphosis in the interest of the politician of the monarchical system of official favorites.

Despite these violations of liberty and justice, the theory and practice of government for the first seventy years of the republic were in the main a realization of Jefferson's ideal. If it had not always been "wise," it had been "frugal." If it had sometimes taken "from the mouth of labor the bread it had earned," it had restrained "men from injuring one another," and left "them otherwise free to regulate their own pursuits of industry and improvement." * Under this *régime* of freedom, the American people wrought the greatest industrial miracle of history. They won a continent from savagery, and turned forests and prairies into farms and gardens; they built hundreds of towns and cities, and established industries of mining and manufacturing of fabulous wealth; they engaged in moral and social reforms that promised a new earth, if not a new heaven. In a word, they exhib-

* American Orations, vol. I, p. 160.

ited a capacity unparalleled since the advent of man to solve "the problems of life" without other impulse than their love of toil and devotion to improvement. But, with the outbreak of the civil war, a new political and social philosophy became the vogue. It was the product of the conditions that always spring from desperate conflicts. Men of action, coping with insurrection, had no taste for the refinements of political speculation, and no use for the limitations of a Constitution. Nothing was of importance to them except the measures that would save the Union. Even freedom, private interests, and cherished institutions had to yield to the exigencies of the hour. Hamilton had feared that "the States, with every power in their hands, will make encroachments upon the national authority till the Union is weakened and dissolved"; * but under the terrific stress of war the Federal Government became omnipotent, threatening to reduce them to administrative departments. Whatever power was thought necessary to raise troops, or to provide revenue, or to crush opposition, was intrusted to it or arrogated by it. No matter how violative of moral or economic law, every act was defended, first, on the ground of necessity, and, later, on the ground of wisdom. When the war was over, the Federal Government, which had performed such miracles, had not simply become all-powerful; it had become all-wise. There was no work it was not thought fitted to do.

When account is taken of the resistless influence of war upon thought and institutions, the revolution wrought in the theory and practice of government in the United States within the past thirty years does not belong to the domain of mystery. It is not to be classed as an inscrutable decree of Providence, designed to hasten the work of civilization. This enlargement of the sphere of government and the loss of freedom it involves have a less cheerful significance. Thy mean that a nation has suffered from the ravages of conflict. Instead, therefore, of welcoming the change as a beneficent "tendency of the times," to use the current phrase, it should be resisted as an onslaught of the forces of barbarism.

To be sure, the founders of the republic had not worked out with Mr. Spencer's precision a theory of government. Science had not put them in possession of the knowledge that has enabled him to define the limits of public authority. Yet in their denunciations of British despotism and in the Bills of Rights with which they prefaced their Constitutions, they set forth principles quite as hostile as those of his Justice to the state socialism now current. Neither did they apply with his rigor of logic the principles of freedom they did proclaim. Widely, at times, did they depart, as I have said, from

* American Orations, vol. i, p. 46.

their political creed. But if not averse to the encouragement of industry that a moderate tariff would give, they never imagined that the throttling of trade, such as began with the Morrill act and ended with that of Mr. Dingley, would come to be defended as a blessing in itself, and turned into a gospel of national wealth and happiness. Nor did they conceive that the Constitution, framed while the memory of the countless evils of an irredcemable currency was still fresh, would ever be quoted in approval of a step so calamitous. Least of all did it occur to them to resort to the power of taxation to suppress the right of a bank to issue its notes, and, with such tyranny as a precedent, to crush a growing traffic in a wholesome food, like the chemical substitutes for butter and cheese, and to extinguish a gambler's passion, like the patronage of a lottery or the solution of missing-word puzzles. They believed with Mr. Spencer that government had a different object. When, however, a nation becomes perverted, as Americans have been, by the evils and ethics of war, the maintenance of peace and freedom ceases to be an article of passionate faith; it is no longer an object of ceaseless pursuit. With ideas and feelings unconsciously and irresistibly shaped, not by constitutions and rational discussion, but by militant necessities, people do not look to themselves for the blessings of life; they look to the power that has shielded them from ruin. To it they intrust, without a doubt of their wisdom or a suspicion of their enslavement, a thousand duties that they alone should assume.

It is not the ignorant and thoughtless that fall a prey to the operation of a social law that they do not understand. People of intelligence and learning as well yield to the bondage of their environment. A member of the United States Supreme Court has repudiated as completely as any blatant socialist the peerless truth that the only government of a free democracy is the one that Jefferson described—the one that "shall restrain men from injuring one another" and "leave them otherwise free to regulate their own pursuits of industry and improvement." In an address before the American Bar Association, Justice Brown endowed the State with the paternal authority of a feudal despotism. "It may," he said, "fix the number of hours of a legal day's work, provide that payment be made at certain stated periods, protect the life and health of workingmen against accidents or diseases arising from ill-constructed machinery, badly ventilated rooms, defective appliances, or dangerous occupations, and may limit or prohibit altogether the labor of women and children in employments injurious to their health or beyond their strength. . . . It may," he added, describing still further the attributes of a government of the fourteenth century instead of the nineteenth, "by constitutional amendment, if necessary, for-

bid the charter of business corporations for any other purpose than those of mining, manufacturing, insurance, or transportation, and especially may inhibit those for farming and trading purposes, or trafficking in any manner in the necessaries of life. . . . It may put an end to combinations having for their object the control and monopoly of particular articles of manufacture. . . . It may put a stop to the vicious system of building railroads and other public works through construction companies organized by the directors of their road in their own interest." He went so far as to express his belief that, if need be, the State might limit the size of bequests. "With its unlimited power to dispose of decedents' estates," he continued, "I know of no reason why the Legislature may not limit the amount which any single individual may take by gift or devise, and thus bring about, to a certain extent, the breaking up of enormous fortunes upon the death of the owner." Becoming the victim of a principle based upon a false practice, he plunged to deeper depths of paternal despotism. "I have never been able," he argued, as is so frequently done these days, "to perceive why, if the Government may be safely intrusted to carry our letters and papers, it may not with equal propriety carry our telegrams and parcels; . . . or why, if our municipalities may supply us with water, they may not also supply us with gas, electricity, telephones, and street cars." *

Were such apostasy to the principles of the founders of the republic confined to the expression of opinion, there might be little occasion for protest or alarm. But it has passed into legislation, both State and Federal, there to work its inevitable havoc, both moral and industrial. Since the close of the war, the laws proposed and enacted in Congress have constantly increased in scope and volume. The solicitude of statesmen is not that of Hamilton and Jefferson—to make the Federal Government the preserver of peace and the protector of freedom—but to convert it into a universal beneficence to fit out fools with brains and to render innocuous the virus of indolence and perversity. Upon the assumption that the American farmers, who have solved so many problems, from the extirpation of beasts and savages to the reclamation of forests and bogs, are no longer able to cope with a grub or beetle or to renew the life of an exhausted soil, an insignificant bureau has been turned into a great department of state. Not only has it been charged with the distribution of seeds, often more valuable to politicians than to agriculturalists, and of voluminous reports more common in junk shops than in libraries, but it has just been authorized to furnish its helpless wards with sample stretches of model roads. As if those miracles of

* Proceedings of the American Bar Association, 1893, p. 235 *et seq.*

industrialism, the railroads of the country, had fallen into the hands of incompetent knaves to be used to plunder and impoverish their patrons, a powerful commission has been mercifully provided to avert the disaster. So slight is the confidence to be placed in the integrity of the men of genius intrusted with the solution of the difficult and complicated problems of transportation that they are denied the freedom to make the needful agreements to forestall the ruin of cutthroat competition. With the faith of idolaters in a state supervision that has been pronounced a failure, the apostates propose that the Government shall depart still further from its legitimate functions, and assume itself the ownership of the railroads, thus adding billions to the spoils to be fought for in caucus and convention. Enamored of the dubious success of the Postal Department, whose wretched management has furnished a deficit for sixty years, they demand that it shall saddle itself with a telegraph service and a savings attachment. A postmaster general has so far taken leave of his senses as to suggest that the savings shall be devoted to the construction of public buildings, which would necessitate the taxation of the depositors to meet the interest paid to them, and make it impossible to provide ready money in case of a run. But it is not alone in the regulation of the great interests of life like agriculture and transportation that the Federal Government has favored the American people with its paternal care and superior wisdom. Descending to more personal matters, it has begun to look after their food and drink. I have mentioned the legislation against the chemical substitutes for butter and cheese. Other legislation, equally violative of personal freedom, seeks to rescue the country from the degradation due to the cheaper grades of tea. Thanks to enlightened statesmen, it must be over a brew of the leaf that has met the official test that the assassins of character will continue the pursuit of their favorite diversion.

The loss of freedom involved in the thousand restraints upon activities that have no kinship with crime is not, however, the most odious product of the civil war. That distinction belongs to the spirit of proscription that now animates the American people—the spirit that formerly took, and still takes to some extent, in the militant countries of Europe, the hideous form of a barbarous persecution of the Jewish race. For three quarters of a century they boasted that the United States were the refuge of the oppressed and unfortunate of all countries. Heartily did they welcome every immigrant, not a pauper or criminal, that was willing to work, no matter whether ignorant or literate, yellow or white. They even sent agents abroad to seduce with stories of freedom and plenty the impoverished victims of military despotisms. With their vast re-

sources undeveloped, they felt, as does every free industrial nation before its apostasy, that too many strangers anxious to better their lot could not come among them and share their blessings. But after the curse of militancy had inclined them, as it inclined the republic of Athens and that of the Dutch, to proscription, they began to change their attitude toward aliens. From the policy of excluding the products of foreign labor, they passed to the policy of excluding foreign labor itself. At the same time they sought to justify themselves with the specious logic that springs from war. Though always contentious of the inevitable triumph of their civilization, they declared that it could not withstand the invasion of Oriental habits and customs. In the face of the fact that no amount of knowledge ever transformed vice into virtue, they insisted that without the test of literacy to bar the ignorance and crime of Europe, the institutions of the republic could not survive. Nothing more hypocritical can be found in the pleas of any of the great brigands of history for their assaults upon the rights or territory of the people ill fated enough to evoke their envy or hatred.

The step from attacking foreigners by prohibitory tariffs and immigration laws to attacking them by means more direct is only a short one. That the American people have taken it already once or twice, and are about to take it again, need cause no surprise. When they were under the domination of slavery, a militant institution stimulative of aggression, it was but yielding to the barbarous impulse that possessed them to annex Texas, to wrest from Mexico a vast domain, and to seek to own the island of Cuba. It was but yielding to the same hateful impulse when, a few years after the close of the civil war, they tried to make Santo Domingo a part of the Union. That act of apostasy to the principles of a free democracy was only averted by the courageous efforts of the few men in public life that still felt profoundly the truths of the Farewell Address. Since then, however, the teachings of Washington have again fallen into disrepute. In the clamor for a "vigorous foreign policy" and the annexation of Hawaii, we have another manifestation of the spirit of aggression that nerved the arm of the slave driver as he wielded the lash and fired him with lust for the lands of other peoples.

The impulse toward despotism since the outbreak of the civil war has not been confined to the Federal Government. The forces of aggression let loose by that terrific struggle have passed to every part of the body politic. It has seemed, in fact, as if they gathered momentum as they became diffused. While the States have not, as already said, encroached upon the rights of the central authority, they have ravaged like flames the field of individual rights. History

does not name the despot that rivaled them in edicts for the regulation of the conduct of his subjects. The enactments of some legislatures number more than a thousand in a single session, and the enactments of all of them more than ten thousand. Is it any wonder that the accumulated mass of these experiments in legislation is fast throwing the law into a state of confusion, defying the labors of lawyers to master it, and of judges to interpret it, and that the American people are beginning to grasp wildly for any scheme that promises deliverance from the evil?

Like the Federal Constitution, the State Constitutions exhibit an anxious desire to rescue from destruction "the unalienable rights." Nearly all of them contain a version of the famous clause of the *Magna Charta*. Were the fundamental principles of government set forth in them rigidly observed, the political despotism that now threatens to overthrow free institutions as completely as in Italy at the close of the middle ages would not be possible. "Absolute, arbitrary power over the lives, liberty, or property of freemen," says the Constitution of Wyoming as well as that of Kentucky, "exists nowhere in a republic, not even in the largest majority." More specific, the Constitution of North Dakota declares that "all men are by nature equally free and independent, and have certain inalienable rights, among which are those of enjoying and defending life and liberty, acquiring, possessing, and protecting property and reputation, and pursuing and obtaining safety and happiness." Nothing could be more admirable than the Constitution of Missouri. It asserts that "all constitutional government is intended to promote the general welfare of the people; that all persons have a natural right to liberty and the enjoyment of the gains of their own industry; that to give security to these things is the principal office of government, and that when government does not confer this security, it fails of its design." The indisputable implication is that the functions of government should be limited to the preservation of order and the enforcement of justice. Were it to undertake anything else, it would not promote "the general welfare"; it would promote the welfare of some at the expense of others. Instead of the system of distribution by private contract, the only equitable one possible, it would introduce the system of distribution by force or favor. Instead of insuring to people "the enjoyment of the gains of their own industry," it would take the gains of some to bestow upon others.

But there is no such correspondence between principle and practice. More even than the acts of Congress do the acts of legislatures illustrate the impotency of any political contrivance, however ingenious, to curb the instincts of a degenerate democracy. Until

recent years the theory of constitution-makers has been that general rules would suffice for the guidance of the patriots that represent the people. But the creed of the Russian highwayman, who offers a prayer before he commits a crime, could hardly be more impotent. Then the theory was adopted that more specific directions would possess a greater virtue. Accordingly, the inhibitions of a statute rather than the principles of a charter became the dominant trait of later constitutions. But all in vain. One has been as impotent as the other. "No act," says the Constitution of Indiana, "shall take effect until the same shall have been published and circulated in the several counties in this State by authority, except in case of emergency, which emergency shall be declared in the preamble or the body of the law." Still, out of two hundred laws passed at one session of the legislature, more than two thirds of them contained the lying declaration that "whereas an emergency exists for the immediate taking effect of this act, it shall therefore be in force from and after its passage." "The General Assembly," says the Constitution of Ohio, repeating a provision common to the Constitutions of other States, "shall pass no special act conferring corporate powers." Yet, of the laws of a single session, fifty were in violation of this provision. A similar provision exists in the Constitution of Tennessee. But only thirty-five of the two hundred and sixty-five acts passed at one session omitted the flagrant falsehood that the "public welfare" required their immediate enforcement. One of these laws so essential to the "public welfare" provided only for the change of the line of a lot. "No county, city, town, or village," says the new Constitution of New York, "shall hereafter give any money or property, or loan its money or credit, to or in aid of any individual, or association, or corporation." To such an extent has this important restriction been disregarded that in one year alone over three million dollars of public funds were put into the hands of private charities. Clergymen and philanthropists even defended the shameless evasion, and the consequent plunder of taxpayers, in the name of humanity.

"Can we believe," said De Tocqueville, grasping sixty years ago the melancholy significance of this want of deference to the most solemn obligations that can be put upon people that govern themselves, "that democracy, which has destroyed the feudal system, will respect the rights of the citizen and capitalist? Will it stop now that it has grown so strong and its adversaries so weak?" If there is little in its contempt for written constitutions to warrant a cheerful answer, there is still less in the most cursory analysis of its State and Territorial legislation. "Statutes have been passed," said Mr. James M. Woolworth before the American Bar Association, giving a glimpse of the character of this legislation, "which have usurped a

man's right to his own, and made contracts for him that he would not have made for himself."

Not the slightest heed is given to the fundamental induction of social science that the advancement of civilization means the enlargement of individual freedom and the growth of moral control. So vast and complex is the machinery of modern industrialism that its management must be left to the people that have staked their fortunes and reputations upon its success. They alone possess the incentive to pursue the line of conduct that shall not evoke the censure of the community, and to make the changes in production and distribution that shall always be adjusted to varying needs and tastes. But the new theory of civilization is that the more enlightened a people become the more unfit they are to shape their own private conduct and to control their own private business. The corollary is that the only power competent to take charge of both and thus avert the untimely crack of doom is the one generated by those marvelous mechanisms of intrigue and corruption—the ballot box and party government. Contemptuous of the irrefutable statement of Buckle that "the best laws which have been passed have been the laws by which some former laws were repealed," legislators are reviving in the New World all the restrictions that crushed the individual and industry in the Old. Creating boards, superintendents, and commissions for almost every conceivable purpose, from the examination of barbers and plumbers to the control of insurance and railroad companies, they are subverting not only personal freedom but local self-government. "One may wonder," says Mr. Gamaliel Bradford in a letter to the Boston Herald, calling attention to this amazing reversion to the despotism of the past, "how many people are aware of the social revolution which is going on year by year at the statehouse; the steady undermining of the local self-government which has been the pride and boast of the State for more than two centuries; the process by which we are being drawn under the centralizing despotism of the Legislature exercised through commissions set up . . . at its pleasure. There are now thirty-four of these," he says, giving figures being rapidly duplicated in other States, "many having extensive executive powers and under no effective responsibility whatever." Like the legislatures themselves, they are new centers of intrigue, corruption, and despotism. Playing the rôle of the old court favorites, intrusted with some monopoly by a complaisant autocrat, they bestow privileges and suppress rights.

The form of property that has most frequently attracted the malign attention of the apostates of democracy is corporate property. Especially provocative of their philanthropy and greed have been those large combinations of capital known as trusts, which are now

the great engines of demagogues to inflame the passions of ignorance and poverty, and to extort blackmail with which to carry on political campaigns and to promote private enrichment. Little or no effort is made to discover whether they are the product of vicious legislation, like tariff laws or imperfect corporation laws, or whether they grow out of economic conditions beyond human control. It is enough that they exist; that, like other members of the society that fosters them, they exercise despotic power; that they serve the purpose of a telling battle cry; that they may be pitilessly plundered. Hence their suppression has become within a year or two a favorite outlet for legislative ignorance, prejudice, and rapacity. Much of the legislation against them is for political purposes, and was never intended to be enforced. But that does not alter the fact that it is violative of the fundamental principles of a free democracy, and indicative of the vice that is fast subverting the purposes of the republic. The antitrust law of New York authorizes one of the most odious practices of the Inquisition—namely, the citation of a witness suspected of a crime under it to give testimony that shall furnish a basis for his indictment and punishment. The antitrust law of Mississippi makes any evidence that a trust or combination intended to affect the price of a commodity, conclusive that the price was affected, and authorizes the infliction upon the innocent of the penalty that should be reserved for the guilty alone. What points could not the authors of such laws have given to the famous despots of history?

The corporate property that has suffered most from the raids of these modern Vandals is the railroads. Originally regarded as the most important and valuable contribution that invention had made to civilization, they were fostered in every way. Now they are regarded as among the greatest of "the social evils" that statesmanship and philanthropy are combating so energetically. By a feat of logic not uncommon to "thinkers" as well as to demagogues, they have been differentiated as creatures of the State, having no rights except those that the State concedes. Upon the vicious theory first proclaimed in the famous Chicago elevator case,* that, unlike other forms of business to meet human needs, they are "affected with public interest," and are not, therefore, private property, entitled to all its rights and privileges, they have been subjected to a despotic supervision that has brought them to the verge of ruin. Denied the right of freedom of contract, one of the "unalienable rights," they are not permitted to make their own rates of transportation. Not

* In this case, it will be remembered, the elevator was private property, built on private land. No one was compelled to use it. Yet, as it was "affected with public interest," the courts decided that the State Legislature could regulate its charges.

believed to be moved, like other commercial enterprises, to seek the convenience and approval of their patrons, they have been forced to construct depots in towns of a certain size, no matter whether business warranted it, to arrange the movement of trains on connecting lines to save a traveler from delay, and to post bulletins to acquaint the impatient public with belated trains and the hour of their arrival. It is assumed by another class of legislation that they revel in the destruction of life and property and the persecution of their employees. One State at least requires the erection of stage planks or the use of trucks for the reception of baggage. In another, locomotives must be armed with lookouts to warn heedless trespassers, and in case of injury or death the company must prove affirmatively that it was not guilty of negligence. In still other States it is provided that there shall be no reduction of salary without a month's notice, no discharge of employees without reasons, if demanded, and no record, or black list, of incompetents or rascals. Even the establishment of relief departments, to which no one is obliged to contribute, is prohibited. To show still further that railroads have no rights that the high-minded legislator is bound to respect, it is provided by one law that they shall pay the charges of other carriers on freight delivered to them; by a second, that they shall issue passes to shippers of certain commodities; and by a third, not confined to railroads, that they shall not employ detectives or other persons to discover dishonesty or to protect their property from the destruction of rioters. In so humane an age as the present, thieves would hardly be refused a privilege so unquestionably just.

As yet but two other classes of corporations outside of elevator and railroad companies have been denied the right to fix the price of their services. This baleful movement of democratic despotism has overtaken telegraph and telephone companies, and threatens the gas and street-car companies. The corporations still free from it have not, however, escaped the blasting solicitude of the social reformers. The owners of mills, factories, and mines have suffered severely from it. But if their hours of toil have been shortened to the verge of disaster; if their discipline of the careless and incompetent has been modified to the point of impotency; if they have had to put up their buildings and to guard their machinery in prescribed ways, not always the wisest; if, in a word, they have been bound and gagged by regulations that rival those with which Colbert throttled the industries of France, the story of their oppression is too much like that of the railroads to need recital. Of more interest because more novel is the oppression of the insurance companies, which, like the railroads, require ability and character of the highest order, and a special knowledge that few legislators take the trouble to master.

Yet they, too, have been treated like fools or knaves. In both fire and life insurance, heavy inroads have been made upon the right of private contract. Fire-insurance companies are forbidden to limit their liability. To encourage the industry of the incendiary, they are denied the right to contest on the ground of fraud the loss they shall pay. Besides crushing their freedom, legislators have raided their revenues. In one State at least contributions are exacted in support of the fire departments in towns of a given size. More onerous than those of fire insurance, the laws in regulation of life insurance declare that the statements made in a policy shall be representations only, and even if false, shall not impair the validity of the contract; that an agreement that a contest shall defeat recovery shall be void; and notwithstanding any provisions of the policy, the non-forfeiture law of the State shall control its interpretation. Official forms of contracts, deemed by Leroy Beaulieu to be the very essence of socialism, are framed and enforced. Although the mortality of blacks is greater than that of whites, no discrimination is permitted; and should an agent wish to add to his business by the abatement of his commissions, he can do so only at the risk of prosecution as a criminal. As well might the physician or attorney be punished for the acceptance of a fee below an official rate.

The vicious assaults of the legislatures upon the rights of corporations are paralleled by equally vicious assaults upon the rights of individuals. Here the police powers of the State have been subjected to the same abuse that has overtaken "the general welfare" clause of the Federal Constitution. Under the cover of them, greed and philanthropy have made equal inroads upon the liberty that Americans boast of so frequently and violate so shamelessly. To such a degree have they been stretched that scarcely a form of human activity from birth to death, both included, has not been subjected to meddlesome supervision. In the absurd attempt of impertinent persons to square the conduct of neighbors to their own notions of right and wrong, the whole field of health, labor, morals, and education has been cultivated with a zeal unequaled in modern times.

Take the laws in revival of the old trade and professional corporations, which were so long a bar to civilization, and did so much to inflame the French Revolution. Those that the plumbers, undertakers, and horseshoers on the one hand, and the dentists, druggists, and physicians on the other, have obtained are as repugnant to the principles of a free democracy as the feudal monopolies of Louis XI and Queen Elizabeth. Yet they have the sanction of the highest court in the land. "In the nature of things," says Justice Bradley, defending this despotic exercise of the police powers of the State,

"it is not every citizen of every age, sex, and condition that is qualified for every calling and position. It is the prerogative of the legislator," he added, framing a rule that would apply to every form of human activity from that of a cook to that of a statesman, "to prescribe regulations founded upon Nature, reason, and experience for the due admission of qualified persons to professions and callings demanding special skill and confidence." * Going a step further in the assertion of this power of a paternal despotism, Judge Napton, of the highest court of Missouri, has declared that "the State legislatures have the power, unless there be something in their own Constitution to prohibit it, of entirely abolishing or placing under restrictions any trade or profession which they may think expedient." Imagine what Jefferson would think of such a doctrine, one that would have obliged him to hunt for a licensed blacksmith to shoe the horse that he rode to the capital to deliver his famous address! Imagine what John Adams would say at the discovery of a law that would not have permitted him to build a drain to his own house, or to buy of a jobber the pipes and faucets needed to repair his plumbing! Would they not be moved to issue a new Declaration, and to fight another War of Independence?

No class of people has suffered more from despotism or has a greater interest in freedom than wage-earners. Civilization made its longest stride when they ceased to be slaves or serfs, and gained the right to go wherever work was to be had and to make with their employers such agreements as they pleased. Still, no class has more completely falsified the praise of Sir Henry Maine, the highest that can be paid to a free democracy. "The American people," he wrote scarcely more than a decade ago, "are still of the opinion that more is to be got for human happiness by private energy than by public legislation." To-day it is upon the State rather than public opinion on the one hand, and industry and frugality upon the other, that toilers have come to rely for the redress of grievances and the procurement of abundance. Guilty themselves of every act of aggression they complain of, they have had enacted the most despotic and discriminating legislation to be found in the statute books.† Besides the well-known laws in regulation of the work of women and children, there is a multitude of other laws still more destructive of freedom. I have mentioned those that require rail-

* Quoted by Tiedeman. Limitations of the Police Power, p. 202.

† According to Mr. F. J. Stimson, the labor laws enacted during the past ten years number sixteen hundred and thirty-nine. Of these, one hundred and fourteen have been declared unconstitutional, which explains the hostility of labor to the courts, and its preposterous demand that when laws have once been enacted they shall stand until repealed. (Atlantic Monthly, November, 1897, p. 606.)

roads and other corporations to give reasons for dismissals, and forbid them to list the knaves and incompetents. But, whatever be the benefit of such laws, the employees of farmers or merchants have no share in them. Equally odious discriminations provide that goods made by union labor shall have the protection of special labels; that wage creditors shall have the preference over clerks and domestic servants; that in suits for manual services, the plaintiff shall get special attorney's fees from the defendant. To the great inconvenience of labor as well as capital, it is not permitted to pay wages in longer periods than those prescribed, or in commodities other than legal tenders. Finally, there are laws that fix the length of day and the rate of wages on public works, thus plundering the men who have to work a longer day and at the lower wages of free competition. But instead of overthrowing by such enactments the despotism of capital, labor only stimulates its growth. For every bureau, every inspector, every aggression on an employer or a fellow-employee, is another drop of vitriol poured upon its own wounds—another nail driven into the coffin of its own freedom.

Though the descendants of the self-reliant and liberty-loving New-Englanders, the farmers of the United States have also fallen a prey to the vicious principles of an apostate democracy. Many of them have surpassed the foreign-born citizens themselves in their devotion to the political ideas that belong to the military despotisms of Europe. In some of the Southern and Western States, where the Anglo-Saxon blood is purest, the subtreasury scheme, the free coinage of silver, and the government ownership and management of railroads and telegraphs have had their greatest vogue. Only among the peasants of the old *régime* would it be possible to find the prototypes of the men that have lost their skill in wresting a living from an exhausted or a half-cultivated soil, and clamor for the aid of the State in their struggle with the forces of Nature and the competition of their fellows. When some De Tocqueville of the future shall study the subversion of American freedom, what a curiosity will he find in the law with its bureaucratic machinery for the extirpation of the gypsy moth! How he will marvel over the decadence of the people that appeal to the same power to save their fruit trees from the ravages of disease and insects, and their fields from the invasion of noxious weeds! If the farmers themselves fail to apply the remedies that benevolent legislators have prescribed, equally benevolent officials are authorized to destroy the trees found diseased, and uproot the weeds before they go to seed. Similar laws have been enacted for the protection of the health of domestic animals. One provides that sheep must be annually dipped to guard against scab. In the case of cattle suspected of tuber-

culosis, officials may subject them to tests, and, if necessary, seize and kill them. In many States the pedigree of an animal has become more important than that of a man, and any falsification of the family tree of a horse or pig is severely punished. Other legislation assumes that Yankee prudence and shrewdness have passed away. Instead of facilitating redress against all frauds, it contains elaborate provisions in regard to the sale of bogus seeds and fertilizers. Finally, there is a mass of legislation, like beef-inspection laws and laws for the regulation or suppression of oleomargarine, that pretends devotion to the public welfare. But its principal object is to cater to greed and to establish monopolies.

Of the liveliest interest to the philanthropic statesman have been all subjects that relate to humanity, morality, and education. It has seemed as if he thought that without his malevolent interference his fellows would lapse into hopeless ignorance and barbarism. Accordingly, he has been at infinite pains to suppress intemperance, to stimulate sympathy and acts of kindness, and to break down any monopoly of intelligence and learning. In all the States there have been established huge and costly mechanisms for the wholesale inculcation of public and private wisdom and virtue. That no child might, through a perverse inclination or parental neglect, wander from the ranks of the droves crowding the public schools, compulsory education has been established. Agents have been appointed to hunt down little delinquents, and veritable prisons constructed to force them to quaff at the fountains of knowledge. More antagonistic even to the principles of a free democracy are the private organizations invested with the police powers of the State to suppress cruelty and vice. Outside of the machinery of responsible government, they wield an authority not subject to the checks of the police. The State has no more to do with the appointment of their agents, who may be grossly ignorant and incompetent, than with the appointment of the agents of a railroad or insurance company. Although supposed to be superior men, I have known them to practice tricks to catch their victims that would disgrace a knave, and to violate private rights with a recklessness hardly surpassed in Russia. The great mass of legislation in regulation of bibulous habits and customs is another reckless invasion of private rights. Without trying to discuss a subject that would fill a volume, I may mention two laws at least that illustrate in an alarming way the assimilation of democratic institutions with those of feudalism. One is the liquor law of New York, with its multitude of despotic and discriminating provisions, inviting evasion, and its centralized officialism, already shown to be grossly inefficient, if not depraved, to enforce them. The other is the dispensary law of South Carolina, which has created

a far more powerful bureaucracy, and has led to much greater social and political demoralization.

The spirit of proscription as well as restriction, so conspicuous in Federal legislation since the civil war, is also potent in State legislation. The Federal Constitution has, of course, made it impossible to establish tariff barriers between the States. But the exaction of licenses of commercial travelers and other checks to inter-State commerce show no lack of will or effort to evade the provision. More successful schemes to prevent foreign competition have been the laws that exclude non-residents from oyster beds and salmon fisheries. Other legislation, equally repugnant to American freedom, forbids to citizens or corporations of other States the ownership and operation of railroads. The feeling against the residents of foreign countries is still more irrational and hostile. The immigration offices established in many States during the period of enlightenment and tolerance have, I believe, with but a single exception, all been abolished. Not only have some of the States forbidden the employment of aliens on public works, but they have forbidden them the ownership of lands within their borders. So rampant has the spirit of intolerance become within the past two years that their exclusion from all other forms of investment has been suggested. Yet we continue to boast of American freedom and enlightenment!

Without tracing the apostacy of American democracy into the narrower but not poorer field of municipal legislation, with its countless ordinances from the regulation of the use of nursing-bottles to the suppression of department stores, let us inquire into the fruits of these exhaustive labors of philanthropists and statesmen. Let us ask whether the one have been commensurate with the other. Have the American people been made moral and humane? While more insistent upon their own rights, have they become more considerate of the rights of others? Can it be said, in a word, that social, political, and industrial life to-day indicates a higher civilization than before the war?

Not to one of these questions can an affirmative answer be given. At no time since the adoption of the Constitution has there been such widespread and well-founded complaint about the greed of capital, the tyranny and brutality of labor, the shocking prevalence of crime, especially lynchings, and the corruption and degradation of politics with the unprecedented growth of the boss system. A legislature does not sit, be it State or national, that is not besieged by men supposed to represent more than any other class the intelligence and morality of the community for favors of every kind—valuable franchises, exemptions from taxation, or other special privileges. The chief argument in behalf of socialism has come to

be that in the management of certain important enterprises they are so indifferent to the public welfare that State control or ownership is the only escape from their exactions. Hardly a great strike occurs that is not accompanied by excesses that only barbarians would commit. When there is no violence, the feeling of hatred on the part of union men toward non-union men takes the form of a persecution more intolerable often than personal assault. Despite primary and ballot reforms and the punishment of bribery, the choice of officials has become more and more the work of a few men, who control caucauses, conventions, and legislatures, and use their immense power to blackmail individuals and corporations to enrich themselves or to advance their political fortunes. As to the grosser forms of crime, the multitude of laws passed to check it has proved equally impotent. Of the prevalence of hoodlumism, even in New England, the home of the Puritan, Prof. Charles Eliot Norton has testified in words of astonishment and alarm. Speaking of the murders throughout the country, Dr. Andrew D. White has stated in a public lecture that they number more than ten thousand a year, and are increasing at a frightful rate. Lynch law is no longer confined to the South, so terribly ravaged by the civil war, nor executed upon negroes alone, nor prescribed only for assaults upon women; it has extended to the North and the West; whites are included among its victims, and robbery or murder suffices to invoke its application.

To many social philosophers such phenomena have been as inexplicable as they have been startling. "Why is it," they ask themselves, "that the more we strive by laws and ordinances to hasten the dawn of the millennium, the darker the heavens get? Is democracy a demon that is not amenable to restraint? Is it destined to triumph over the forces of righteousness, and wreck the very civilization that brought it forth?" Yet they go on believing that these thousands and tens of thousands of edicts of despotic democracy, which work a moral as well as economic havoc that passes computation, are so many novel and valuable experiments in social science—so many attempts more or less successful to solve its great problems. As though every other despot from time immemorial had not made them before; as though, in civilized communities, where moral control is fast taking the place of political control, they could produce any other effect than the one so greatly feared! It is not by sowing the wind that the whirlwind is laid. It is not by acts of aggression, no matter how pure their motive or lofty their aim, that the world is bettered. For, gild the deed as we may, every law passed, every office created, every dollar appropriated beyond the preservation of order and the enforcement of justice, the great

purpose of the founders of the republic, is an invasion of freedom and a step toward degradation. As has invariably happened, and as Hamilton so clearly foresaw, such a policy will eventually turn the most civilized people into a race of barbarians, prone not only to assail one another but to attack their neighbors at home and abroad. In another way, and in that way only, must the goal of human existence be attained; it is to put within the reach of the poorest and weakest the means to resist the rich and strong. Instead of spending countless millions upon a work that should be left to the people themselves, the work of education, the regulation of morals, labor, and trade, the initiation and management of industrial enterprises, spend them, if need be, upon the establishment of a scrupulous justice free to all. Then will it be possible to mitigate and, in time, to end the countless evils of vice and crime that come of war and despotism. Then will people learn to provide for themselves the thousand blessings, moral and material, born of peace and freedom. Then will be solved the only problems of democracy that require or admit of solution—the simple but weighty problems of self-support and self-control.

FABRIC-MARKED POTTERY.

By F. S. DELLENBAUGH.

THE cord markings on American pottery have been usually ascribed mainly to a desire on the part of the aboriginal potter for decoration. While this may in some cases have been the purpose of the application of the fabrics, which are so distinctly seen in the casts made by Mr. Holmes, it has occurred to me that originally the decorative purpose, if there was any, was quite a secondary matter, and that the real object of the net or coarse fabric was to aid construction. It was one of the means invoked by the primitive potter to enable him to handle his pot or jar when complete and before it could receive the firing.

As these vessels show no evidence of the "coil" process, he must have used some kind of a mold or form. If built on interior molds of indurated clay, as has been suggested,* there would be great difficulty in removing the pot from the mold, hence it seems to me this was not the kind of mold used.

The earlier potters probably used baskets that came up to the curved-in part of the jar, which was continued above the basket by

* George E. Sellers. Popular Science Monthly, vol. xi, p. 573.

deft handling, or, if a basket of the same form was followed, the basket was destroyed in the firing process. This would seem to the modern mind a great waste of time and material, but it must be remembered that the Indian potter had not learned modern haste, and besides could turn up a coarse basket in a very short time. Therefore it does not seem improbable that he may, in the early stages, have modeled his jar on the *inside* of a basket frame of similar form and then allowed the basket to be consumed in the baking

FIG. 1.—A FABRIC-MARKED JAR.

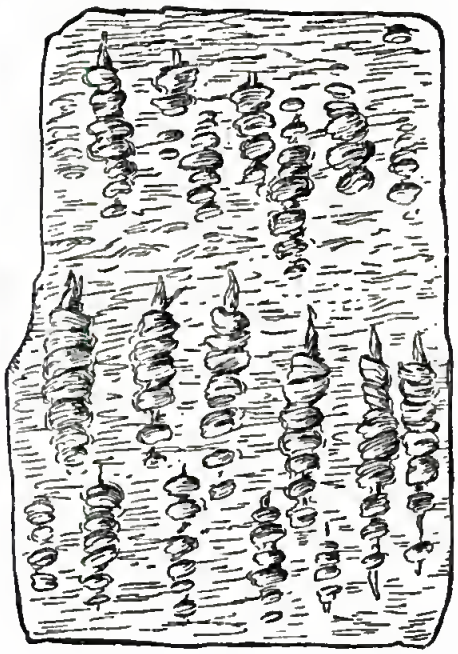

FIG. 2.

process when it could not be separated from the vessel. Even when he developed to a point beyond and modeled the upper portions with a free hand, he would find great trouble in separating his jar from its framework. What, therefore, would be the following step? It seems to me it would have been the placing between the clay and the mold of a piece of netting, which would permit him to lift out his jar easily and intact, and transport it to the drying place. He would then speedily discover that his basket was not necessary—was not so serviceable, in fact, as a hole in the ground, for the sides of the hole could be plastered with a layer of very sandy clay, and thus would all sticking of the vessel to its mold be avoided.

The netting, or fabric, having been spread as evenly as possible over the inside surface of the mold hole, the upper edges were allowed to lie out upon the ground. The soft clay being now pressed evenly upon the fabric to the required thickness, the sandy surface of the mold hole easily gave it shape and gave the potter

no anxiety about the outside surface. Indeed, he had but one surface to watch till he came to the incurve, if his vessel was to have a narrow mouth. Then, I surmise, he built up roughly a clay mold, well sanded, pressing what was left of his fabric into the inside of this mold as he built his vessel upward. Frequently, doubtless, the fabric was not sufficient to go to the top, which explains why sometimes only a part of a jar shows the cord markings. The jar completed, it was easy to pull away the upper mold shell of clay and by means of the fabric lift the vessel out of the mold hole and remove it to the drying spot, where the fabric was peeled off and handles or other projecting parts added. The cord-markings are plainly shown in Plate XXXIX, from Mr. Holmes's casts.

The distorting and overlapping of the meshes observed by Mr. Holmes were probably due to the gathering in to fit the interior of the mold, for it must be borne in mind that the fabric was not shaped in any way to fit the mold, but was doubtless a fragment of some squarely woven article. Thus gathering and overlapping were necessary to make it conform to the inside surface of the mold.

When coarse basketry was used for a mold that was intended to be removed before firing, the interstices of the basket work were probably rubbed full of a mixture of sand and clay to prevent the finished vessel from sticking or catching, which explains, I think, the peculiarity of design in some cases, for only the more prominent features of the basket work would impress the vessel. In Mr. Holmes's fine paper on this subject in the Third Annual Report of the United States Bureau of Ethnology, the illustrations—Figs. 107, 108, 109, 111, and 112—present this peculiarity of design, due to the fact that the chief members of the basketry were covered by the sand-clay mixture. It seems quite probable that to gain stiffness these baskets may also have been put into a ground mold. I have not been able to examine the interstices in the casts Mr. Holmes so cleverly made, but a careful examination would probably show evidences in favor of the mold-hole idea. The fabrics used,

Fig. 3.

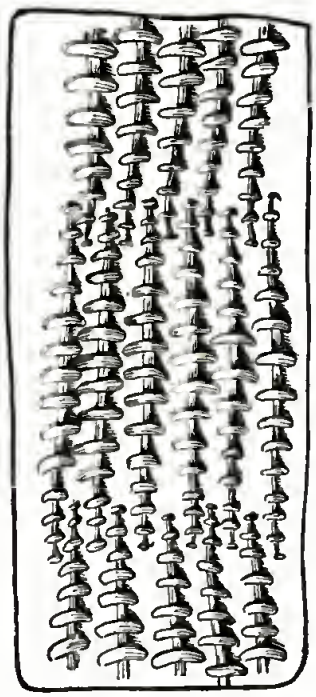

Fig. 4.

being of a uniform thickness and easily removed, impressed themselves fully upon the exterior surface of the jar, the plain portions being the impress of the smoothed sides of the mold hole. Of the wicker-marked ware, however, only the prominent projections of the form made an impression, the plain surfaces corresponding to the sandy filling that was resorted to for preventing the soft clay from squeezing into and through the interstices. In some kinds of basketry more filling was necessary than in others, which explains the frequent greater separation and irregularity of the markings. For example, Fig. 5 shows far less of the wicker impressions than Fig. 3, and Fig. 2 gives only the irregular salients of an exceedingly coarse support. It seems probable that the wicker-marked pottery is the most primitive, and an extended study of it might lead to a clearer understanding of the beginnings of pottery-making. The next distinct advance was apparently the use of a fabric as a base, supported by some smooth surface, and then as a further development the coil ware, a process still in use among the Moki, and the simplest and easiest way of modeling a clay vessel without the aid of the wheel; progress in pottery, as in other arts, having been in the direction of simplicity of construction combined with skill in execution.

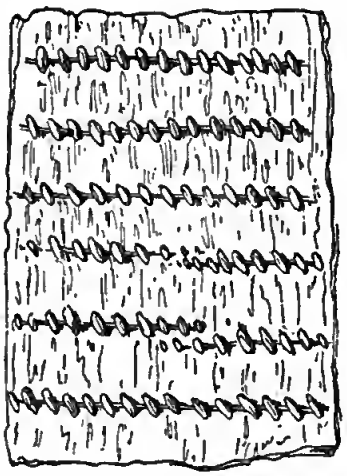

FIG. 5.

The probable line of development in pottery-making was then about like this:

1. Made on the *outside* of a wicker form. Confined chiefly to bowls. 2. Made on the *inside* of a wicker form. 3. Made on netting in mold hole. 4. Coil-made. 5. Wheel-made, which Indians seem never to have attained.

There was doubtless no sharp line of separation anywhere between these several stages, but they merged into each other as the dawn merges into the day.

THE most important of the accessions to the library of Columbia University during 1897 was a gift of 387 books, mainly illustrated works in art, architecture, and natural history. Among them are Audubon's Quadrupeds, Sepp's *Nederlandsche Insekten*, Gould's Humming Birds, Le Vaillant's *Oiseaux d'Afrique*, and other illustrated works in natural history, many of them colored by hand; a hand-colored copy of Catlin's American Indians, Schoolcraft's Indians, Pennant's Archæological and Zoölogical Works, with rare and valuable portraits, and books on the Baltic provinces, Livonia, and Frisia.

IN A WORLD HALF AS LARGE.

By the Late M. J. DELBŒUF.

LAPLACE says, in his *Exposition du Système du Monde:* "The law of attraction inversely as the square of the distance is that of emanations starting from a center. It appears to be the law of all forces the action of which is perceptible at sensible distances, as we recognize in electrical and magnetic forces. This law, therefore, responding exactly to all phenomena, should be regarded in its simplicity and its generality as rigorous. One of its remarkable properties is, that if the dimensions of all the bodies in the universe, their mutual distances, and their velocities should be increased or diminished proportionately, they would describe curves like those they now describe; so that the universe, thus successively reduced to the smallest imaginable space, would always present to observers the same appearance. These appearances are, consequently, independent of the dimensions of the universe, since, by virtue of the law of proportionality of force and velocity, they are independent of the movement it may have in space. The simplicity of the laws of Nature thus permits us to observe and recognize only these relations."

This masterly page contains propositions of different natures. Some of them are of an exclusively mechanical order; as those which teach that attractive forces, emanating from a center, act in inverse proportion to the squares of the distances; that this appears to be the law of all forces acting at sensible distances; that its simplicity and generality should cause it to be regarded as rigorous; and that the consequence flows from it that we may conceive an infinity of universes mechanically alike—that is, built upon all imaginable scales. These propositions, even if they had not the support of Newton, would acquire an incontestable authority from the single fact that Laplace advanced them.

Other of these propositions lie in the domain of psychology and metaphysics. Such are those that assert that these infinitely numerous universes, built on different scales, enlarged or diminished, would always present the same appearances to observers; and that, consequently, these appearances are independent of the dimensions of the universe, because the simplicity of the laws of Nature permits us to observe and recognize only relations. From all this we are authorized to infer as a final consequence which Laplace does not deduce explicitly, but which was assuredly in his thought, that the universe has fundamentally no fixed, immutable, absolute dimensions; that it is, in short, a purely geometrical universe, constructed in a homogeneous space, of which the proportions have the same

properties, whatever their extent. I propose to demonstrate the fallacy of these consequences.

For this purpose I reduce this proposition to its simplest dimension, and speak, in our planetary system, only of the sun and our globe. If this system and all it contains were reduced to one half the present linear dimensions, if the velocity of the earth in its orbit were one half less, the densities of the sun and the earth remaining the same in homologous points, there would be, according to the theorem of Laplace, no other change than of dimensions, and an observer belonging to the system would not perceive any; only an observer placed outside of the system and having a standard of comparison being competent to notice it.

Or the problem may be presented in another way. We might keep the two systems, the original and the reduced one, inclosing them, in thought, one within the other, with the centers of their two suns coinciding. If the two planets were in corresponding parts of their orbits at the same time, an observer at the common center would see only the smaller one, because it would always conceal the larger.

To make the matter plainer, let us call the fictitious planet Mars. In fact, what we are going to say will nearly apply to the real Mars, whose radius is 0.517 that of the earth, and its density 0.95 that of the earth. We remark, also, that Mars receives only half as much heat as the earth. Our imaginary Mars shall be an exact image of the earth; with the same seas and continents, the same flora and fauna, the same peoples, the same cities, and the same monuments; and a person who might be transported in his sleep would be carried from one to the other, provided his own size was correspondingly diminished, without perceiving that he had changed his abode, so long as he confined his attention to the phenomena of space. If we suppose the year to consist of three hundred and sixty-five days of the same length as our days, which we may legitimately do, there would be no change in the relations of time. Generally, there will be no change in the senses of touch and sight, so far as they relate to surfaces.

Supposing our imaginary Martians to have invented a system of weights and measures resting on a like basis with the French metric system, their measures of length will be of half the value of ours; of surface, one fourth; of capacity, one eighth; and their weights, into the valuation of which other elements will enter, one sixteenth.

Hence, if we suppose the mean weight of an earthly man to be eighty kilogrammes, that of the Martian would be only five kilogrammes.

The difference in the relations of the measure of capacity and the weight deduced from it, according to the rules of the metric sys-

tem, which is brought out in the above, arises from the fact that capacity is a thing of three dimensions, while weight has four. Mass, being for the same density proportional to the volume, has, in kind, only three dimensions; but weight has four, because it is mass multiplied by a new factor, gravity, which is not the same on our Mars as on the earth. Some extremely curious consequences have their origin in this fact.

Megamicros, as we shall call our man of the earth transported in his sleep to the new Mars, wakes up, opens his eyes, and finds himself in bed in his room. All the things in it are familiar to him—the furniture, clothes, books, and wares are just where he had left them overnight. He does not suspect the trick that has been played on him. He stretches himself, throws up his arms, leaps from his bed, goes to the washstand, lifts the pitcher, puts on his clothes—and is greatly surprised.

All these actions are of a common character, and consist in raising masses to a certain height. His water pitcher, for instance, holds two litres, new measure. On the earth these two litres, representing two kilogrammes, require a certain effort to be raised, say, to the height of thirty centimetres. But on Mars these two litres weigh only two Martian kilogrammes, or sixteen times less in earthly weight. Further, he does not have to lift them to a height of thirty centimetres, but of only fifteen centimetres, his size being diminished one half; so that the work to be performed is reduced to one thirty-second. On the other hand, his strength, which is proportioned to the volume or the mass of his muscles, is only reduced to one eighth. Consequently, the effort he is required to make is four times less. His water pitcher seems extremely light; so do his clothes. He probably remarked the same thing when he threw up his arms and jumped from his bed, but simply thought he was in unusually good spirits.

If he is in the habit of practicing in gymnastics, and if, on the earth, he raised weights of fifty kilogrammes above his head, he is no little astonished to see that he can now play with weights four times as heavy, or of two hundred kilogrammes.

He prepares to go out. He walks across the length and breadth of his room. There is nothing unusual. The room is smaller, indeed, but his steps are correspondingly shorter. He goes downstairs. He feels again a wonderful lightness and spring. He hardly has to touch the steps. When he goes upstairs his astonishment increases, if that is possible, for he can go up four steps at a time. His muscular energy, it is true, is reduced in proportion to his volume, or to one eighth, but his weight is reduced to a sixteenth, and he only has to lift it half as high.

If, feeling so spry, he thinks he will play a little, he is again surprised to find that while he could formerly leap only to the height of his hips, he can now jump twice as high as his head. If the Eiffel Tower is near by, and he climbs it, he gets to the top four times as quickly as formerly. If he lives in Savoy and climbs Mont Blanc, he feels only one fourth the fatigue of the olden time, and will be very apt to think that somebody has given him a very full dose of some invigorating extract while he was asleep. He is no less astonished when he finds how little danger there is in falling. His child falls down a whole story without being hurt, and he drops fragile things, his water pitcher, for example, without their breaking.

In the same way, but inversely, the inhabitant of Mars, transplanted to the earth, would feel four times as heavy: his leaps would be only a quarter as high; the steps, going up and down stairs, would be four times too high, although they would look the same as ever. Any climb, not to speak of the Eiffel Tower or of Mont Blanc, would take away his breath; and he would be ready to think he had all at once become decrepit.

Fairy stories, and such humorists as Swift and Voltaire, have made us familiar with the idea that there may be cities of dwarfs and of giants copied exactly from ours; and we do not perceive, at first sight, why they should not have their Paris, with the Louvre, boulevards, and hotels, built after earthly models. We could easily fancy that if Gulliver, arriving at Lilliput or Brobdingnag, had become smaller or larger, according to the measure of his hosts, he would not have remarked the diminutiveness of Lilliput and the Lilliputians, or the great size of Brobdingnag, and the Brobdingnagians. This fancy is the more natural at first sight because we have invented the art of drawing and other arts relating to it, and the microscope and photography show us every day considerable enlargements and diminutions without alteration of shapes.

It is, however, not consistent with the most incontestable results of science. The cat is not an exact reduction of the tiger, or the Lilliputian of the Brobdingnagian, any more than a small crystal of alum is a reduction of a large crystal—although one regular octahedron may be the exact image of another octahedron. For if they were, there would no longer be a question of atoms, or molecules, or cells. From the geometrical point of view the cell, the molecule, and the atom are infinitely divisible universes, and therefore capable of containing all imaginable figures within their limits; while from the chemical and physiological point of view they are absolute quantities not capable of reduction in their kind.

Now let us see if a Martian house can be constructed wholly on the plan of an earthly house—that is, if it can be made to present the

same proportions in all its parts. The cube of the construction and the cubic dimensions of the rooms, as well as the number of windows and their superficial proportions, might indeed be the same; but we will consider here the details of construction in view of the materials used. Let us reduce the problem to its simplest expression: a beam on two supports in a condition to bear the weight of a man. Let P be this weight; l, b, and h, the length of the beam between the points of support, its breadth, and thickness; and R, the resistance of the wood. According to a well-known formula, we have: $P=\frac{2Rbh^2}{3l}$ which means that the weight that can be supported increases directly in proportion to the resistance of the wood, the breadth of the beam, and the square of its thickness, and inversely as the distance between the supports.

Since on Mars, according to the data of the problem, R suffers no change, while b, h, and l become $\frac{b}{2}$, $\frac{h}{2}$, and $\frac{l}{2}$, we see that the weight which the geometrically reduced apparatus can support will be equal to $\frac{P}{4}$. We have just seen that the weight of a Martian is $\frac{P}{16}$. Consequently, the apparatus will be four times as solid as necessary. The Martians could use joists and planks proportionately only half as thick or one quarter as broad, or with supports four times as far apart, or any other combination that would reduce the second member of the equation to one sixteenth.

From what we have said of the lightness of the Martians, it would appear that their division walls and fences would have to be relatively four times, absolutely twice as high as with us.

Now, suppose Megamicros preparing to continue on Mars some work he had begun on the earth. He has a bench, planks, nails, and a hammer. His hammer is of seven eighths less volume and mass, and its weight is reduced to one sixteenth. Himself smaller in size, he can no longer lift the instrument to the same height, so that on a final analysis the living force of the hammer reduced in weight is only one thirty-second. The nail is only half as long, and of only one fourth section; so that, supposing the same rigidity, he meets only one eighth of the resistance in driving it into the board. Megamicros then finds that his hammer is four times too light, and can not understand what makes it so.

If the real Martians have passed, like us, through a stone age and come to an iron age, they have had to work with implements relatively four times larger than ours, and are now using hammers of corresponding dimensions.

To return to our imaginary Martians. It may be objected that

the mass of the hammer being eight times less, and the muscular force being no more than eight times less, the velocity impressed upon the hammer will not be half, but equal. The objection is well founded; but then the phenomenon of the fall of the hammer will not be the same as it would be on the earth. An observer situated in the common center of the two suns would see the Martian's hammer drop twice as fast as the terrestrian's. Or the objection might take another form. The velocity of the hammer may remain proportional, but the muscular exhaustion will be four times less, so that the workman can quadruple the number of his blows. In this case the temporal phenomenon, if I may call it that, will be changed. At any rate, if he does not multiply his blows, the nail will not be driven in in the same way. To whichever side we turn, we fall into the same definitive conclusion.

We further remark that the Martians can lift loads four times as heavy as ours: first, because they do not have to carry them so high; and, secondly, because the weight is only half as much. Thus the unfortunate people who built the pyramids on Mars would require only a quarter of the time. Consequently, Megamicros will see all tasks that consist in raising weights performed four times as rapidly. If he builds a house, it will be under roof before he could have got it aboveground on the earth. Life thus passes more rapidly on Mars than on the earth; and yet we can not think of diminishing the length of the days, for then we would increase the number in the year to fourteen hundred and sixty; for we have supposed the new Martian year to be of the same length as that of the earth.

Megamicros, who has learned on the earth to reckon by terrestrial measures, will have a new set to deal with when he is transported to the new Mars. Some may say that he will experience no difficulty in this. They are mistaken.

To speak first of measures of length and surface: If Megamicros required six square metres of cloth to make himself a complete suit of clothes when he was on the earth, he will need no more on Mars, because the surface of his body which he has to cover is diminished in the same proportion as that of the square metre, or as four to one. But as the sun sends him no more heat there than our sun does to us, the goods he will select must be at least as warm as on the earth. No reduction, therefore, is possible in their thickness. Hence, if he himself makes the goods he requires, if his wife knits his stockings and his vests, they will be surprised at the amount of labor they will have to expend, and the quantity of materials they will have to use for the same purpose. With a skein of a hundred metres of yarn, working with a double thread, they will not make more than half of

what they expect to. It will be as if their metre, already shortened one half, were reduced another half. Hence the acre they may devote to the cultivation of flax or hemp or cotton will fall far short of furnishing them as many shirts.

With respect to measures of capacity and weight: On the earth Megamicros quenched his thirst with two litres of wine. These two litres restored to him the quantity of liquid which he lost by transpiration and excretion. Without speaking of excretions, the Martian man will lose perceptibly more by evaporation alone than he did on the earth; for while his mass is reduced to one eighth, his surface is only reduced to one fourth. He will, therefore, lose twice as much by transpiration as he did before, and a litre of wine will not seem to contain more than half the same sum of satisfaction. For a like reason, a kilogramme of bread will not appease hunger in the same measure as on the earth. For food, besides furnishing energy to the muscles, serves, by repairing the loss of caloric, to maintain the animal heat. The cooling surface of the body is twice as great in proportion to the mass; the kilogramme of bread will, therefore, not procure the same sum of muscular energy. We know, as a fact, that small animals have to eat and drink relatively more than large animals.

Megamicros will feel a change of temperature on Mars more than when he was on the earth. He gets cool and is warmed again in less time, when all other things are equal. If a cloud passes over the sun, he will immediately feel a depression of the temperature of his skin. It is a very sensitive thermometer. Two thermometers, geometrically alike, do not act in the same manner. There is no synchronism in their movements. All such disagreements arise from the fact that surfaces do not diminish in the same proportion as volumes.

The problem becomes more and more complicated as we address ourselves to more delicate phenomena. Muscular energy is due to the burning by oxygen of the carbon contained in the blood. This combustion is effected on the surface of the lungs. The quantity of blood of a Martian is eight times less than that of a being of the earth. But while the thoracic cage is diminished in the proportion of eight to one, the pulmonary surface is so only in the proportion of four to one. The combustion is therefore more complete with the Martian than with the man of the earth. Consequently his muscular energy, the effects of which were already so striking in consequence of the reduction of weight, will be still more marked by virtue of this circumstance. On the other hand, combustion being more active, the kilogramme of bread, which we have already found not enough, becomes still more insufficient—a new pertur-

bation. Another consequence: we have just said that the cube of the houses *might* be, on Mars, proportional to the cube of our houses. But if boards of health should proceed there according to the same principles as with us, they would have to order larger and higher rooms. It may be suggested that the atmosphere of Mars is less dense than ours, because it is not so thick, and gravity is less there. Here is, indeed, a great difficulty, which, fortunately, it is not necessary to resolve, because the law of Laplace supposes that the density is the same at homologous points. On the surface of Mars the air, then, has the same density and the same composition as on the surface of the earth. But will the inspirations be as long? The diaphragm of the Martians has not the same work to do as that of the earth people. It is true that it is only half as thick, but its surface is only a quarter, and the amplitude of its movement only one half. But we must not discuss the rhythm of the diaphragm or the beatings of the heart unless we shorten the days and increase the number in a year.

We see that whichever way we turn we can not for an instant entertain the illusion that an earth-man could be put on Mars without knowing it.

We shall fall into more and more inextricable difficulties if we go further into the detail of the respiratory and circulatory phenomena. The capillary vessels of the Martians are four times narrower in section. The heart, then, would have to use more force to make the blood circulate; yet the heart is much weaker, with thinner walls, smaller cavities, etc. Even if the Martians resemble men externally, their whole interior organization must be decidedly very different.

The persistency will be remarked with which the number four recurs in these calculations. This is because weight is reduced one half on Mars, and also, because of the reduction in their linear dimensions, the Martians have to exercise only half the effort to produce the same apparent effect. It might be concluded from this that if the universe was reduced geometrically in the proportion of three or of five to one, we should immediately find ourselves nine or twenty-five times lighter, stronger, and more active. By an inverse conclusion, if we could imagine the case for a few moments, we should have to be three or five times larger. Hence the paradoxical conclusion that the smaller the world is, the larger its people should be; so that, if the smallest asteroids are inhabited by men, the inhabitants would be more important in size than their planet, and might, in case of extremity, take it in their arms. On the other hand, the larger the planetary mass, the smaller the men should be, if their muscular sensations are comparable to ours.

If we have brothers living on Jupiter, they must be about the size of ants.

If, indeed, we go down to the bottom of the matter, we shall be forced to admit that there is, in a being capable of observing and discerning, something permanent, fixed, and superior to spatial dimensions, and independent of their variations. This something is the feeling of the required effort, of the executed movement, and the fatigue that follows it. The feeling appertains essentially to every muscle that works under the impulsion of the will. This feeling is neither line, nor surface, nor volume, nor weight. It is the same for small and large animals, for the child and the man, the dwarf and the giant. He who lifts the heaviest weight he can manage fatigues himself always just so much, whether he be weak or strong, fresh and nimble or tired and dull, sturdy or feeble. The ant dragging a straw experiences integrally the same feeling as the porter carrying a sack, or the horse pulling a wagon, if the straw, the sack, and the wagon are proportioned to the strength of the ant, the man, and the horse.

Magamicros, transported to Mars, has retained in himself the inner unity of measure that permits him to estimate masses according to his strength. When on the earth he lifts loads of fifty kilogrammes greatest weight, the equivalent of this weight on Mars is not for him fifty Martian kilogrammes, but two hundred kilogrammes greatest weight. Hence his astonishment. I say, purposely, sometimes weight and sometimes mass. Fundamentally, he estimates weight; but weight represents to him a certain quantity of matter as related to his strength and his requirements. No matter if the kilogramme of Mars is only equivalent to one sixteenth of the kilogramme of the earth. If a Martian kilogramme of meat, bread, or beans represents on Mars the same relative amount of work or pleasure as the earthly kilogramme of meat, bread, or beans does on the earth, it is equivalent, even equal to it; but if Megamicros does not find in it the same quality of restoring strength or producing pleasure, he will think it is different.

Pleasure, pain, and fatigue are not measured by the metre, litre, or kilogramme. The pleasure felt by a grasshopper in eating a blade of grass is not less than that of a cow with the range of a whole pasture. But we know that the grasshopper has a more pressing need of food than the cow, because it is smaller. If, then, by an ideal reduction of proportions, the cow fails to get the same satisfaction out of the meadow, she will not judge its size by sight, but by her stomach.

Let us go still further. None of my readers has thought of raising the objection that while transporting Megamicros to Mars

I have diminished him in other respects but not in intelligence, and that I should have given him only a half, a quarter, or an eighth of judgment. There would be no reason in this. I have received from Biskra a uromastix—a kind of herbivorous lizard, with its tail armed with points. Not having any Algerian plants to feed it, I put it in a field where there were all kinds of wild flowers. The animal found the flowers of the smartweed to its taste. Wishing to vary its diet, and particularly to find something it would eat in winter, I tried to feed it other things; but, though it was docile and ate smartweed, fumitory flowers, and wood violets from the hand, it showed a marked aversion or indifference to clover. One day, in my impatience, not having found any smartweed, I opened its mouth and forced in a clover blossom which it finally swallowed. The next day, to my astonishment, having some clover blossoms in my hand, the animal seized them and devoured them with evident greedy pleasure. It recognized the plant it had been forced to swallow and had found good, though it had despised it before. It had got rid of a prejudice. Would a rhinoceros have acted more rationally? Who would have thought of its large size giving it more intelligence?

A very important conclusion results from our discussion. Laplace's law is true mechanically, within the strict limits in which it is announced. But the psychical consequences Laplace draws from it are fallacies, and the simplest phenomena of elasticity make the fallacy evident. Yet if the law of universal attraction were all we had by which to account for every kind of manifestations, psychical as well as physical, or, in other words, if there were nothing in the universe but material atoms situated at perceptible distances apart, and attracting one another in proportion to their masses and inversely as the squares of their distances, Laplace's conclusion would be impregnable; an observer could not perceive any diminution or augmentation in the universe. But why? Because there would be no longer an observer. As I have demonstrated, the moment there is an observer, he will perceive a change; and if he perceives it, it is undoubtedly because the faculty of observation escapes—with others—the law of universal attraction; because it does not depend solely upon the mass of the atoms and their distance. It is the same with the ant and with the elephant.

A final conclusion is that if all these deductions are exact, real space is different from geometrical space, and the dimensions of the universe are absolute.—*Translated for the Popular Science Monthly from Ciel et Terre.*

THE FIRST THERMOMETERS.

By M. P. DUHEM.

THE thermometer, the Abbé Nollet writes, came for the first time from the hands of a peasant of North Holland. This peasant, whose name was Drebbel, was not, however, in fact, one of those coarse fellows who know of nothing but field work; he seems to have been of a diligent nature, and had apparently some knowledge of the physics of the time. An ingenious inventor as well as an impudent pretender, and boasting that he had discovered perpetual motion, while he made great advances in the art of dyeing cloths, he secured favors from James I; Rodolf II gave him liberal pensions and brought him to his court; and Ferdinand II, who was himself interested in the thermometer, chose him as the tutor for his son.

Drebbel's thermometer—an invention which he may have borrowed from Porta, and in which Galileo doubtless preceded him—was composed of a vertical glass tube ending at the top in a bulb, while the lower end was plunged into a vessel filled with water or some colored liquid. When the bulb was warmed, a part of the air contained within it was driven back into the water and escaped without. When the air became cool again as the temperature around it, the external pressure caused the liquid to rise in the tube, the limit of its ascent being determined by the degree to which the air in the bulb had been heated, and the tension it had acquired.

This hardly practical apparatus was still used in Germany as late as 1621. The members of the Accademia del Cimento, with their active interest in all physical progress, soon substituted for it the more convenient instrument which we still use. Contained in a transparent bulb prolonged into a fine tube, a liquid more dilatable than the bulb rose in the tube when it was warmed, and descended when it was cooled. The Florentine Academy, moreover, never let any physical discovery pass without trying to apply it to the healing art. Galileo had hardly recognized the constancy of the time of the oscillations of the pendulum before the pendulum was used to determine the rapidity or the slowness of the pulses of patients. The thermometer, made convenient and portable, became in the hands of the Venetian physiologist Santorio Santori a sensitive and precise indicator of the progress of fever. Santori's writings made the instrument popular, and it was soon common in the enamelers' shops as the Florence or Sanctorius thermometer.

It is hard to imagine the interest that was excited by the indications of this instrument, which was declared to be "worthy of

Archimedes." Everybody was curious to observe the ascent or descent of the colored spirit in the tube; for, Nollet wrote, "the physician, guided by the thermometer, can labor with more certainty and success; the good citizen is better informed regarding the variations that concern the health of men and the productions of the earth; and the individual who is trying to procure the conveniences of life is informed by it as to what he must do in order to live all the year in a nearly uniform temperature." According to Amontons, Colbert had a project for constructing a large number of thermometers and sending them to different parts of the earth for making observations on seasons and climates, but was obliged to give it up on account of the imperfect character of the spirit thermometer of the time. Different instruments would not agree.

The marking of the degrees on the thermometer stems was not controlled by any fixed rule, and they therefore did not express the same heat or the same cold by the same number of degrees. To remedy this defect, some physicists advised that the lowest point reached in the extreme cold of winter and the highest in summer be marked, and the space between be divided into a hundred equal parts. Such a thermometer would indeed permit its owner to compare the cold and heat of different years; but in communicating his observations to another he would give him data that would have no meaning unless he also sent him the instrument he had used, or one having identical graduations.

The problem was first solved in 1702 by Amontons; and his method, although it has been given up and resumed at intervals, has now become the normal one to which all others are subordinated. It is based upon two observations, both of which are of primary importance. We take two masses of air in two bulbs. Each of these masses is separated from the outer air by a curved tube filled with mercury, forming a manometer. Suppose that at a given temperature one of these masses supports a pressure of one, and the other of two atmospheres. Warm the two masses of air equally, and pour into both manometers enough mercury to maintain invariable the volume occupied by each of them. While the pressure supported by the first mass will increase to a certain amount, that sustained by the other mass will increase doubly. The pressure on the second will always be double that on the first. Thus, when we warm the two masses equally, while keeping invariable the volume of the recipients containing them, a constant relation will be maintained between the pressures supported by them. This is Amontons's first observation.

In the second observation, which can be made with an arbitrarily

graduated thermometer, the temperature of boiling water is found to be invariable. Not only does the thermometer immersed in water keep for any number of hours of boiling the height it had reached when the first bubbles came up, but it ascends to the same point every time it is placed in boiling water. If Amontons had added the proviso that the pressure of the atmosphere should be the same in all the experiments, which we know now is indispensable, he would have been rigorously exact.

When we take a bulb of air connected with a manometer, mark carefully the pressure which it sustains when it is plunged into boiling water, and then the pressure at which, under other circumstances, it reaches the same volume, the ratio of that pressure to the former may be regarded as expressing the ratio between the temperature to which the air was raised under the latter condition to the fixed temperature of boiling water. This ratio will be the same, whatever thermometer, constructed in the same way, we may use. In this way we have a sure means of obtaining instruments that can be compared with one another.

Amontons proposed for a thermometer, as Drebbel did, a mass of air maintained at a constant volume under a variable pressure. The rule by which he attached a certain degree of temperature to each degree of heat and cold, or a larger number for more intense heat and a smaller for cold, is the same rule to which Desormes and Clément on the one hand, and Laplace on the other, returned a century afterward; and is the rule proposed in the works of Sadi Carnot, Clausius, and Lord Kelvin as the measure of the absolute temperature.

The profound reasons which cause us to prefer the definition of temperature proposed by Amontons to every other could not be divined at the beginning of the eighteenth century. The large size and inconvenient shape of Amontons's instrument, and the necessity of taking account of the variations of atmospheric pressure in interpreting its indications, prevented its general adoption; and the Florence thermometer was still preferred. Spirit thermometers, that could be compared with one another, were in demand. Réaumur furnished them.

Réaumur observed, in 1730, that a thermometer placed in freezing water went down to a certain degree, and remained fixed there as long as the water was not wholly solidified. The temperature of water in process of congelation was therefore always the same, and fixed. As physics has advanced, some corrections have been made in this law, and causes have been discovered that make the point of congelation of water vary; and physicists have been induced, in view of it, to take as their fixed temperature, instead of the freez-

ing point of water, the melting point of it. But neither these corrections nor the incidental recognition by the Florentine Academicians of the invariability of the melting point of ice diminish the importance of Réaumur's discovery.

Having discovered a fixed temperature, Réaumur deduced a way of making spirit thermometers that could be compared with one another. If we plunge a glass bulb prolonged into a fine tube and filled with spirit into freezing water, and draw a line marked zero flush with the top of the liquid, then determine the volume occupied by the liquid under these conditions; if we divide the tube into portions, the interior capacity of which represents at the temperature of the freezing of water aliquot parts of that volume—hundredths, for example—and number these divisions from the line marked zero; then if, in an experiment, we see the spirit rise to the level of the division marked five, we know that the spirit in the glass has suffered an apparent dilatation of five hundredths between the freezing temperature of water and the temperature of the experiment. If we always take care to use spirit of the same quality —and Réaumur prescribed minute rules on this subject—and if we neglect the changes which the variable nature of the glass will introduce into the law of dilatation of the thermometric receptacle, we will obtain instruments of a kind that will always mark the same degree when they are equally heated or cooled.

For two instruments constructed according to the laws laid down by Réaumur to be rigorously comparable, it was essential that they be made of the same glass and filled with the same liquid. If the glass of which they are made has not exactly the same composition and tempering in both, and the alcohol has not the same degree of concentration, they will not agree. In order to diminish these variations, it is convenient to fix all thermometers, whatever they may be made of, so that they shall give the same indications for two fixed temperatures. The point reached by the liquid at the lower of these temperatures is marked on the instrument, and then it is raised to the higher temperature, and the point which it reaches then is marked. The interval is then divided into parts having the same interior volume, and the division is carried out beyond the fixed points. In such thermometers the liquid will stand at the same mark for an equal degree of heat, notwithstanding slight inequalities in the glass and the fluid.

It was some time before the two fixed temperatures at which the thermometric scale should be marked were determined upon. Dalencé, in 1688, took a mixture of water and ice for the zero, and the melting point of butter as the upper point. Renaldini, in 1694, recommended a mixture of water and ice and the boiling point of

water, but his process was not applicable to the alcohol thermometers then in use, for the vapor of alcohol has a tension at the boiling point of water which would burst the reservoirs of the instruments. And Renaldini's method could not be adopted till after Musschenbroeck had introduced the use of mercury. In 1729, Delisle chose as graduating points the temperature of ice-water and the almost invariable temperature of the cellars of the Observatory at Paris.

About 1714 a skillful instrument-maker of Dantsic, Daniel Gabriel Fahrenheit, furnished chemists with alcohol thermometers which he replaced in 1720 with mercury thermometers, the indications given by which all agreed with one another. According to the chemist Woulfe, he boasted that he could make a thermometer that would agree with those he had already made in any place, and without seeing any of the instruments that had already gone out of his hands; but he would not divulge the process by which he had been able to obtain such an agreement. This process, in establishing which he had been aided by the advice of the astronomer Roemer, was nothing else than the method devised by Dalencé; but Fahrenheit took for his zero the temperature of a mixture of ice and muriate of ammonia (chloride of ammonium)—which, he thought, was the greatest cold that could be obtained—and for his higher degree the temperature of the human body.

Finally, in 1742, the Swede, Andrew Celsius, proposed to restore the method of Renaldini, and divide into a hundred degrees the interval which the mercury in the thermometer would traverse between the temperature of melting ice and that of boiling water. He marked the lower temperature 100, and the higher 0. Linnæus, reversing this order, gave the mercury thermometer (centigrade) the form under which it is now known.—*Translated for the Popular Science Monthly from the Revue des Deux Mondes.*

CARL VOGT, his son William relates, thought little of honorary titles and decorations, and generally refused them when offered him; while he highly appreciated sincere and spontaneous tributes to the value of anything he had done. Finally, his friends convinced him that a traveler who could exhibit some badge of knighthood might receive better treatment at the customhouses than one who had none, and he accepted the last cross of the French Legion of Honor that Gambetta conferred. At dinner one evening in Berlin, his hostess, after proudly exhibiting her orders, asked him about his. He had none, he said, except the cross that Gambetta gave him. Perceiving that this was not well received, he bethought himself, and added: "Oh. I forgot. I wear, too, the blue and white badge of the Society of Cooks of Munich, and am very proud of it, because they gave it to me of their own accord after I had translated Brillat-Savarin."

SKETCH OF SIR JOSEPH LISTER.

THE merits of Lord Lister's work in the institution of antiseptic and aseptic surgery are recognized as of the very highest value to the human race, and all nations are delighted to do him honor for it. The general feeling is summarized in an English chronicle which says that for it "he is justly regarded as one of the world's greatest benefactors." Prof. H. Tillmanns, in an estimate of him published in Nature's "Scientific Worthies," speaks of it as his "immortal life-work," and as constituting "the greatest advance which surgery has ever made."

Sir Joseph Lister received by descent the tastes and aptitudes which have enabled him to reach his present eminence. His father, Joseph Jackson Lister, though a man in business, found time to devote to science, was a Fellow of the Royal Society, devised an improvement in the microscope, concerning which he published a paper on achromatic glasses in the Philosophical Transactions; contributed other papers to that publication; and, with Dr. Hodgkin, first described the tendency of the red corpuscles of the blood to arrange themselves in rouleaux.

Joseph Lister was born at Upton in Essex, England, in 1827; was taught at a private school of the Society of Friends in Tottenham; was graduated Bachelor of Arts at the University of London in 1847; and studied medicine at University College, London, where his attention was specially directed to physiology. Having been graduated in medicine from the University of London in 1852, and enjoyed a creditable career at the hospital, he went to Edinburgh, where he became associated with the late Professor Syme, whose daughter he married, and was his house surgeon for a time. He was appointed assistant surgeon to the Royal Infirmary, and extra-academical lecturer on surgery, in which capacities he added to his reputation. In 1860 he was appointed regius professor of surgery in the University of Glasgow. During all this period he published many papers, the general trend of which seemed to direct itself toward the field on which he has won his supreme fame. His first papers, published in 1853, while he was still a student, were on the muscular tissue of the skin and the contractible tissue of the iris. Of papers published in Edinburgh between 1857 and 1860, those dealing with the subjects of inflammation and the coagulation of the blood are mentioned as having been the most important. The expressions of his views on this last subject were one of the features of his Croonian Lecture of 1862, which, Nature says, "excited great interest, upsetting as it did most of the accepted

notions, and forming the groundwork of much of our modern teaching on the subject."

Lister's work in connection with antiseptic surgery began while he was at Glasgow. Some of the surgical wards of the Royal Infirmary there were distinguished for their unhealthiness, in which they were hardly surpassed in the kingdom. The method he employed then was very crude and rudimentary, but he applied it with the result, as he was able to believe he could say without exaggeration, that those particular wards became "the healthiest in the world; while other wards, separated from mine only by a passage a few feet broad, where former modes of treatment were for a while continued, retained their former insalubrity." Equally striking changes were afterward witnessed in other institutions, as in the Allgemeines Krankenhaus in Munich, the director of which, Professor von Nussbaum, sent his assistant to Edinburgh, whither Lister had removed, to learn the details of the antiseptic system as it was then practiced. From the day the system was introduced into the Krankenhaus, hospital gangrene, which had infected eighty per cent of the wounds treated, disappeared entirely, and pyæmia and erysipelas soon followed it. "But it was by no means only in removing the unhealthiness of hospitals that the antiseptic system showed its benefits. Inflammation being suppressed, with attendant pain, fever, and wasting discharge, the sufferings of the patient were, of course, immensely lessened; rapid primary union being now the rule, convalescence was correspondingly curtailed; while as regards safety and the essential nature, it became a matter of indifference whether the wound had clean-cut surfaces which could be closely approximated, or whether the injury inflicted had been such as to cause destruction of tissue. And operations which had been regarded from time immemorial as unjustifiable were adopted with complete safety."

Lister relates in his British Association address that he had been long impressed with the greatness of the evil of putrefaction in surgery, and had done his best to mitigate it by the use of various deodorant lotions. It does not appear to have been quite clear as yet what the cause of it was. Liebig's theory that it was an effect of oxygen was still current; and if this were the fact, the prevention altogether seemed to be hopeless. "But when Pasteur had shown that putrefaction was a fermentation caused by the growth of microbes, and that these could not arise *de novo* in the decomposable substance, the problem assumed a more hopeful aspect. If the wound could be treated with some substance which, without doing too serious mischief to the human tissues, would kill the microbes already contained in it and prevent the future access of

others in the living state, putrefaction might be prevented, however freely the air with its oxygen might enter." He had heard of carbolic acid as having a remarkable deodorizing effect on sewage, and, having obtained a quantity, determined to try it in compound fractures. "Applying it undiluted to the wound, with an arrangement for its occasional renewal, I had the joy of seeing those formidable injuries follow the same safe and tranquil course as simple fractures in which the skin remains unbroken." The earliest antiseptic dressings were very cumbrous. At first an antiseptic crust of blood and pure carbolic acid was formed, and protected by a sheet of block tin; next carbolic acid and oil were used; then a layer of putty made with carbolic acid was applied; after this, a plaster made of shellac and carbolic acid. This was superseded by the typical dressing, or the Lister bandage, in which a layer of waterproof silk, the "protective," was placed over the wound to protect it from the direct action of the irritant substance in the antiseptic dressing materials; over this came some eight or more layers of carbolized gauze or muslin, with a sheet of gutta-percha tissue between the outer two of these. The whole was then bound round with carbolized gauze, so as to effect as far as possible an air-tight inclosure of the wound. With this was associated a spraying of carbolic acid when the wound was being treated or the bandages were being applied or changed, in order to prevent the access of microbes in the air. As the structure of the bandage became gradually simpler and more convenient, so the system itself was improved and simplified till, while the principle remains the same, the mode of applying it has become very different from what it was at first. The most important of these improvements seems to have been suggested in 1871 or 1872 by a paper of Dr. Burdon Sanderson's showing that bacteria, unlike the spores of fungi, are deprived of vitality by mere desiccation at an ordinary temperature, so that, while a drop of water from ordinary sources or the contact of a moist surface is sure to lead to bacteric development and putrefaction in an organic substance susceptible of that change, the access of dust from exposure to the atmosphere merely induces the growth of fungi and comparatively insignificant chemical alteration. "If this were true," Lister said, in a communication to the Royal Society of Edinburgh made in April, 1873, "it would be needless to provide an antiseptic atmosphere in carrying out the antiseptic system of treatment; and all that would be requisite in the performance of a surgical operation would be to have the skin of the part about to be operated upon treated once for all with an efficient antiseptic, while the hands of the surgeon and his assistants and also his instruments were similarly purified; a dressing being afterward used to guard

against the subsequent access of septic material. Thus the use of the spray might be dispensed with, and no one would rejoice more than myself in getting rid of that complication." The suggestion thus indicated was not acted upon in surgical practice till after much testing and experiment, by which Lister was led to conclude, definitely, that it was the grosser forms of septic mischief, rather than microbes in the attenuated condition in which they exist in the atmosphere, that were to be dreaded in surgical practice. At the London Medical Congress, in 1881, he hinted that it might turn out possible to disregard altogether the atmospheric dust, but he still did not venture as yet to try this upon his patients.

At the Berlin Congress, in 1890, he brought forward what he regarded as absolute demonstration of the harmlessness of the atmospheric dust in surgical operations and of the sufficiency of methods in which irritation of the wound by strong antiseptics was avoided.

Under the method now in use, as described by Prof. H. Tillmanns in Nature's "Scientific Worthies," "operations are performed with almost painfully precise sterilization of every object or instrument employed, as Lister first taught us to do, while at the same time we limit as far as possible the action of irritant antiseptics, such as carbolic acid, and even advantageously use none at all, operating with as little fluid as possible. So far as it may be necessary, the fluid now employed is a sterilized solution of common salt, or else sterilized water. In the place, then, of carrying out our operations under the former strictly antiseptic precautions, we now operate aseptically. But the fundamental idea on which Lister's antiseptic method was based has remained unchanged, and will always be the same. . . . The operational area on the patient is carefully disinfected in accordance with Lister's instructions, and is surrounded with aseptic linen compresses sterilized in steam at from 100° to 130° C. We employ exact and definite methods to free our hands from microbes, and the instruments are sterilized by boiling in one-per-cent solution of sodium carbonate. All bandages and the outer garments we wear are made aseptic by prolonged exposure to steam at from 100° to 130° C., in a specially constructed apparatus; and so, also, in respect to all else. Steam thus provides us nowadays with non-irritant bandaging materials free from germs with even greater certainty than did their earliest impregnation with antiseptic substances. . . . Instead of sponges we now use muslin absorbents sterilized by steam, and these, like every other fragment of bandaging material, are burned after being used but once. In short, the technics of modern surgery is based on Lister's method,

and takes for its watchword, 'asepsis without the use of antiseptics.' Antisepsis has given place to asepsis, but the latter is just as surely based on the ground first broken by Lister." The earlier results that followed the application of Lister's methods are described as having been simply astounding, and the feelings they inspired as like those that follow "a mighty victory finally won after prolonged and grievous defeats." In those hospitals where septicæmia had been most certain, the best results were obtained, and wound fevers came to be no longer dreaded. Equally good and certain results attend the treatment carried out under aseptic precautions. Surgery now hardly hesitates at anything, but fearlessly deals with every organ of the human body. Operations that were approached with extreme hesitation, or were put off till the last possible moment, or were not ventured upon at all, are now undertaken fearlessly, and with the certainty that no harm will come in them from putrefaction. "It now celebrates its greatest triumph in dealing with the skull and cranial cavity, with the brain, spinal column and spinal canal, with the thoracic and abdominal viscera, with bones and joints, with tendons and nerves; and patients are not afraid to trust themselves with the surgeons in the most delicate operations, and such as once would have been certainly fatal.

Lister's views were much controverted at first, and it was a long time before they were generally accepted in England. Then, when the application of the system had been modified in the light of additional study and experiment, and it became aseptic instead of antiseptic, they said that he had shifted his ground. This was not so, for the fundamental principle on which it has rested has all been the same, and the differences in application are only of detail; and, as we have already seen, he was almost from the beginning considering whether he could not dispense with the spraying, having deduced the conclusion that it was not indispensable long before he ventured to omit it.

Professor Tillmanns claims that it was in Germany first, rather than in England, that Lister's scientific works met with their earliest recognition and general appreciation; tells how he, like other German surgeons, sought out "the founder of modern surgery" in his London hospital, and, "filled with gratitude," laid his homage at his feet; and gleefully speaks of the ovation which the professors and students offered him a few years ago at Leipsic.

In 1869 Lister was appointed to the chair of clinical surgery in the University of Edinburgh, where he succeeded Dr. Syme, his father-in-law; where large and enthusiastic classes listened to his lectures; whence the reputation of his clinic extended through the

world; and where he continued the elaboration of his system, introducing some of the simplifications we have already described. In 1877 he was appointed to suceeed Sir William Ferguson as professor of clinical surgery at King's College, London. He held this position till 1893. In 1876 he was appointed by the Privy Council to the General Medical Council for Scotland.

Lister's later writings, consisting mainly of articles scattered through various periodicals, have been devoted chiefly to subjects connected with the germ theory of disease, and include investigations into the processes of fermentation and the life history of certain micro-organisms, and papers on the bearing of bacteriology upon surgical treatment.

The discovery of the antiseptic system is a matter of such transcendent importance as almost to obscure the many other improvements and modifications which Lister introduced into surgical practice. He devised a way of bloodless amputation by simply elevating the limb, so that an emptying of it was effected both mechanically and by means of a contraction of the arteries consequent upon the altered position. He invented a tourniquet for compressing the abdominal aorta, whereby the hæmorrhage was diminished in operations in the neighborhood of the hip joint. He introduced the amputation called by his name, and an operation for excision of the wrist. He was the first to undertake osteotomy for the purpose of rectifying deformity of the limbs. He advocated a more complete method than had been practiced of operating on cancer of the breast, and introduced the treatment of fractures of the patella and other bones communicating with joints by means of open incisions and wiring.

The medal of the Royal Society was conferred on Dr. Lister in 1880; and in 1881 the prize of the French Academy of Sciences was awarded to him for his observations and discoveries in the application of the antiseptic treatment in surgery. In 1883 he was made a baronet on the recommendation of Mr. Gladstone. In 1896 he was president of the British Association, and in his presidential address gave an extremely modest narrative of his experiments and the development of his aseptic method. He has received numerous honorary degrees and honors from colleges and learned societies. He succeeded Lord Kelvin as president of the Royal Society in 1895; was raised to the peerage as Lord Kinnear in 1897; and is surgeon extraordinary to the Queen.

Correspondence.

PROFESSOR DRUMMOND'S MISTAKE.

Editor Popular Science Monthly:

DEAR SIR: The ordinary reader, having neither the time nor the facilities for verifying much of what he reads, must needs take a great deal for granted.

And this habit of childlike confidence applies especially to the numerous quotations he encounters, for he very naturally assumes that no writer of any pretensions and standing can he so utterly lost to all that is fair and honorable as to deliberately misquote and misrepresent a fellow-craftsman and serve him up to undeserved ridicule. Yet experience proves that it is not prudent to rely too implicitly upon the infallibility of any writer, for it is sometimes apparent that even those who pose as the most strenuous sticklers for the truth when it comes to quoting from the works of rival contemporaries are not always so successful in resisting a natural propensity to lie as was the poet Schiller.

Criminal carelessness also accounts for many of these garbled quotations, and we find too that in some instances the offender has taken them second hand, and is himself the victim of misplaced confidence, as in the case of Professor Drummond, whose high character constrains us to believe that it was because of his too ready reliance upon the accuracy and integrity of a certain writer in the Contemporary Review that he committed the flagrant injustice of incorporating in his admirable book, the Ascent of Man, not only a palpably garbled version of Herbert Spencer's definition of evolution, but also the sarcastic comments of this unprincipled critic upon his own miserable perversion of it.

But while granting full absolution to the erring professor, we can not but wonder nevertheless that he should have been so easily betrayed into this grave injustice, when, had he carefully read the very paragraph from Spencer to which he refers the reader, he must have discovered how false and misleading was this citation from the Review, as will plainly appear from the following comparison:

On page 5 of the third edition of the Ascent of Man (James Potts, publisher, 1894) we read: "Mr. Herbert Spencer's famous definition of evolution, as a change from an indefinite coherent heterogeneity to a definite coherent heterogeneity through continuous differentiations and integrations," etc., while the version as given on page 65 of Spencer's Data of Ethics, to which Mr. Drummond refers us, is really as follows: "Taking the evolution point of view, and remembering that while an aggregate evolves not only the matter composing it, but also the motion of that matter passes from an indefinite *in*coherent *homo*geneity to a definite coherent heterogencity," etc.

It will be observed how effectually the substitution of the underscored syllables clarifies the alleged version and redeems it from utter and idiotic unintelligibility.

Even when correctly stated we may have differing opinions as to the clearness, consistency, and scientific value of Mr. Spencer's "famous definition," but we can not differ as to his right to have it quoted correctly, and doubtless Professor Drummond would have so quoted it but for his overweening confidence in the careless or mendacious reviewer before alluded to.

JAMES W. DONALDSON.

ELLENVILLE, N. Y., *November 6, 1897.*

A PROTEST.

Editor Popular Science Monthly:

SIR: In an article entitled The Foreign Element in American Civilization, published in the Popular Science Monthly for January, the writer, referring to the Irish, states, "He is first an Irishman, then an American, and such only so far as it is an America of the green flag." To prove his proposition he refers to the great pilgrimage to Ireland this summer to celebrate the centenary of 1798.

It has been conceded by all impartial writers that of all nationalities there is none that more readily or more naturally assimilates as an American citizen or forms a more integral part of the great republic than the Irishman. Every true American feels, knows, and enthusiastically declares that of all human emotions there is none more powerful as an incentive to grand and noble deeds than that which brings us back to the spot where we first received a mother's smile, a father's blessing, to the cradle of our childhood, the playground of our boyhood, the theater of our manhood. I appeal to every battlefield of the Revolution, from Stony Point to Yorktown, upon which Irish blood flowed freely, and the Irish sunburst waved side by side with the red, white, and blue. I appeal to Wayne's bayonets, Knox's artillery, and Morgan's rifles.

> "New force we want to stem the brunt,
> So bring the Irish to the front."

They were brought to the front at Stony Point, Monmouth, Bennington, King's Mountain, and the Cowpens. I appeal to the volcanic heights, the towers, the gates, the cactus-circled fortresses of Mexico. I appeal to the bloody slopes of Malvern Hill, the

crimson stone wall of Fredericksburg, the deadly swamps of the Chickahominy, the thickets of the Wilderness, the purple waters of Antietam, and the bloody angle at Gettysburg. I appeal to the hundred fields now hillowed with Irish graves to prove that never man fought more devotedly or more heroically for the inviolability of the Stars and Stripes and the indissoluhility of the Union than did the men who cherished in their hearts the memories and love of their native land.

Their fame will live as long as the Great Republic herself—yea, while mountains raise their summits to the sky and rivers journey onward to the sea—

> "While Fame her record keeps,
> Or Honor points the hallowed spot
> Where Valor proudly sleeps."

DR. J. C. O'CONNELL.

WASHINGTON, D. C., *February 1, 1898.*

A CORRECTION.

Editor Popular Science Monthly:

DEAR SIR: In the Sketch of Carl Vogt iu the last Novemher number of the Popular Science Monthly, Prof. Charles Follen, of Harvard University (1825–1835), was referred to as "implicated in the assassination of Kotzehue." This statement, unexplained, is misleading and unjust. Two months after the assassination Carl Follenius, at the time teaching in Jena, was hrought to trial by a hostile government as an accomplice, hut was fully acquitted. In those disturhed times—1819—this vague charge was easily made, hut should not now he allowed to pursue unchallenged the memory of so estimahle a man as Dr. Follen, with whose entire life it was inconsistent.

Will you he so kind as to insert this statement in an early number of your magazine? Very truly yours,

CHARLES W. ELIOT.

HARVARD UNIVERSITY, CAMARIDGE,
January 6, 1898.

HAD space permitted, the writer of the sketch of Carl Vogt would have more fully set forth the real nature of the incident referred to, which the Vogt family evidently considered anything but a discredit. He did not regard it as derogatory to Professor Follen's character, and mentioned it simply as tending to estahlish a bond between Carl Vogt and the United States, and as showing that Vogt's revolutionary sympathies were an affair of the blood. We are glad to puhlish President Eliot's letter, and the fact that Follenius was acquitted on his trial, which is not mentioned in William Vogt's life of his father, *La Vie d'un Homme—Carl Vogt*, whence the material for the sketch was derived. That work opens with a pen picture of two young students—Carl Sand and Carl Follenius—casting dice, at an inn hetween Erfurt and Jena, as to which should slay Kotzehue. The lot fell to Sand. William Vogt further records that Follenius, "they say," when Sand confided his purpose to him, ahhorring murder, tried to dissuade him from carrying it out, as he did, too, after the casting; hnt, finding Sand was immovable, he "demanded for himself, Follenius, the perilous honor of striking down the monster" (*réclama pour lui, Follenius, le périlleux honneur d'abattre le monstre*); also that Follenius attended the execution of Sand, and embraced him on the scaffold. He was afterward banished from Germany and took refuge in Switzerland, where he was professor of civil law at Basle, till the monarchs of the Holy Alliance demanded his extradition. He then went to Paris on the invitation of Lafayette, and thence came to America.—EDITOR.

Editor's Table.

THE CLAIMS OF SCIENCE.

A PROFESSOR of biology in one of our leading universities has lately been discussing the question how far an acceptance of the doctrine of evolution is compatible with religious orthodoxy of the evangelical type. The answer he gives is on the whole comforting to those who desire to recognize new truth without breaking entirely away from old and cherished opinions. He acknowledges that science has rectified our understanding of the word "create," and so far thrown new light upon the interpretation of a Hebrew term. We are ready to admit that a term in present use in our own language may undergo a change of meaning, for this is a process which we see in constant operation; but it seems a little arbitrary to say that a word in a virtually extinct language must be taken in a new sense simply because

the new sense better fits lately discovered facts. The point, however, is not one which we care to discuss at length; and if the learned professor says that the Hebrew lexicon should be revised from time to time, so as to keep it abreast of modern physical science, we see no reason to object. Let the authorities on Semitic philology look to it.

It is admitted by the writer to whom we are referring that evolution compels us to "view types and design in a new light." Types are not to be considered as "artificial models to which all actual cases must more or less closely conform." We must rather look on them as "the generalized results of variations during past generations, the accumulated effects of growth and variations somehow or other acquired in the past and, we know not why, persisting by heredity." They are not, he distinctly says, "a stamp impressed from without." As to the manifestations of design, we must regard them as "dependent on some internal qualities by which organisms became accommodated to the exigencies of their place in the world." The choice is presented to them, we are told, of becoming so accommodated or perishing; some manage the accommodation and some perish. It is needless to say that there is very little left here of the old and venerable doctrine of design, and that in the account above given of type the classical idea is equally attenuated. There is, nevertheless, we are assured, no reason why we should not "regard all these phenomena as illustrating the method of divine creation and government."

Coming down to particular theological doctrines, the writer claims that they may one and all be held consistently with a full acceptance of the evolutionary standpoint; and here again we have no desire whatever to dispute his contention. What science demands above all things is intellectual sincerity and integrity. Science in its infinite variety interests different minds in many different ways; and he who has the true scientific spirit will, so far as the order of facts in which he is especially interested is concerned, follow to the very best of his ability a rigorous scientific method. In other regions of thought or speculation he may be less exacting as to proof and more disposed to indulge what Bagehot called "the emotion of belief." Science grows by what is done for her in different fields by men who themselves may be widely at variance with one another as regards large sections of their thought. It is therefore unwise for any one to attempt to set up, in the name of science, one scheme of opinion upon all subjects for all classes of minds. We have known, or at least heard of, graceless zealots of materialism who called in question Faraday's claims to be a true man of science because he did not carry the inductive method into questions of religious belief. It is fortunate that the interests of science are not committed to the hands of such; for no possible rigor of method could make amends for the incurable narrowness of their imagination.

Science, we have said, demands intellectual integrity, and it rests with each individual, upon his own responsibility as an individual, to satisfy its demands. Science means truth; it exists to establish and advance truth, to build up in the world a coherent system of doctrine valuable for the guidance of human life and the further enlargement of human thought. It is not for one worker unnecessarily to judge another, or to impugn his fidelity to the great cause to which all owe a

common allegiance. All that we can require of any man is that he should honestly present any facts with which he may be called upon to deal, and that he should not refuse a candid examination to any relevant evidence in matters that lie within the scope of his inquiries. It is no part of the business of science or of any one speaking in the name of science to say how a given individual shall assess the evidence on a given question. There is such a thing at times as *force majeure* in intellectual as well as in political or military matters; and where this manifestly exists for one who works strenuously for science in his own field, others who do not feel the stress may properly refrain from disrespectful comments. We hold that the message of science comes home to every man in some measure or other, bidding him to work for the truth, to rid his mind of delusion, of partiality, of prejudice, of distorting self interest. Some respond to the appeal more perfectly than others; but it would not be safe to say that, where the most complete *tabula rasa* has been produced, there the greatest amount of scientific energy will be disengaged.

Holding these views, we are prepared to allow the fullest freedom to every one to reconcile in any way he pleases his religious convictions with his scientific views. *How* the reconciliation is effected is not our concern; it is the concern of each individual that it shall be an honest one. It is his concern and it is his responsibility; why should a stranger meddle therewith? The message of religion, reduced to its simplest terms, is identical with the message of science: "Be true!" and the man who consciously fails of intellectual sincerity will not feel much happier on the religious than on the purely intellectual side. It is high time that Ephraim ceased to envy Judah, and Judah to vex Ephraim. There is ample work in the world both for science and for religion. It is for science to establish order among ascertained phenomena and to deduce from them the laws, or some of the laws, which govern the succession of events and prescribe the conditions of human life. It is for religion to uphold the sanctity of the moral law, to which science might be tempted not to assign any special pre-eminence, and to keep open an outlook into the origin and essential nature of things, and into those as yet unrealized possibilities of existence which science, full fed upon certainties, might be disposed to ignore. Science and religion may each watch over the other with advantage, seeing that each has a besetting sin—science a tendency to a hard intellectual pride, and religion a tendency to superstition and general indifference to external evidence. If each would recognize its own weakness and accept in good part the services of the other, the result would be a higher type of moral and intellectual life than has hitherto prevailed.

Science, it must, however, be understood, is unyielding in its demand that the adhesion of the mind to any opinion or conclusion shall be governed by evidence and not determined by mere views of expediency or convenience. There is therefore a somewhat unscientific tone in the remarks of our professor when he says: "We will continue to believe that in our creation we received from God a moral nature and an immortal spirit; that we have somehow become demoralized, and that the taint of our degeneracy is hereditary." It is not scientific to say "We *will* continue to believe" anything; if we *will* to believe, we turn our back on evidence, or at least are prepared to do so. And if it is not scientific to say

"we *will* believe," it is not very strictly theological to speak of believing that we have "somehow become demoralized." There is no "somehow," so far as we understand, in the orthodox view of this question, but a very definite "how." It is again very doubtful to our mind whether it is consistent with a profession of evolutionism to hold that the nature of man was originally pure and that "somehow" it degenerated. The course of evolution in the moral sphere is from actions guided by lower impulses to actions guided by higher impulses, from purely self regarding actions to actions in which the welfare of others in ever-widening circles is taken into account. It is hard to imagine an evolution from a higher to a lower moral state.

There is a story told of John Wesley that a certain man who had come under his influence consulted him one day as to whether he might continue to wear a very handsome and expensive coat which he had bought. "Oh, yes," said Wesley, "just wear it as long as you can—as long as your conscience will allow you." More than this the great religious reformer would not say. Science has a very similar answer to give to certain inquirers: they are quite free to hold this or that opinion as long as they can—honestly. So long as they hold it honestly, Science has no fault to find with them. When the day comes, if it ever comes, that they can hold it honestly no longer, Science says, "Put it off." And any religion worthy of the name would say the same thing.

THE UPWARD STRUGGLE OF SOCIETY.

THERE is much in the present condition of society, not only in this country but in most of the civilized countries of the world, to give food for serious reflection as to the future to all thoughtful minds. The laws of social evolution, we commonly say, have brought us to the point where we now are; and, as this is a considerable improvement on the conditions which obtained at certain periods in the past, we have no reason whatever to be anxious as to what the future may bring forth. On the other hand, when things are demonstrably going wrong, it seems a little too much like indifference and levity to trust to the operation of some law wholly independent of our own volition or effort to put them right. Evolution, after all, is only a kind of moving balance of actions and reactions: and we do not think that Mr. Spencer himself would undertake to guarantee us against many a bad half hour in the future, if we do not ourselves see that measures are taken to remedy obvious faults in the social development of our time. One of bis books, every one will remember, is entitled The Coming Slavery—not a word of promise, to say the least of it.

The difficulties of the present time are, to a large extent, the result of the very successes which society has achieved in the past. Improved economic conditions have produced vaster accumulations of wealth than the world ever saw before, and in doing so have brought the spectacle of luxury before the eyes of the multitude in a manner, and with a frequency, only too well fitted to produce envy and unrest. In former times there were a comparatively few great ones of the earth whose splendor was a dazzling vision that, seen at comparatively rare intervals, lent a certain amount of poetry to the lives of the poorer classes. Today there is no poetry in wealth: it is something that everybody understands, and from which no one, broadly speaking, feels content to be shut out. It is looked upon as the

key to the limitless satisfaction of desire, as the great emancipator from the otherwise hard conditions of life. In the days when wealth was associated with political power and responsibility, there was a kind of mute feeling in the multitude that such a combination required special qualities of mind and character which were not within the compass of all. To-day wealth stands by itself, wholly divorced in the popular mind from the notion of responsibility; and there is none so poor as not to consider himself fully qualified for the possession of any amount of it. It is not too much to say that many desire wealth, whether they are distinctly conscious of it or not, on account of the *ir*responsibility which they think or feel goes with it.

That this is not a healthful condition of the popular mind need hardly be insisted on. Yet it not only exists, but it is fed and ministered to in a thousand ways, and combated but in few. The rich, for the most part, justify by their mode of living and the education they give their children the popular idea of the irresponsibility of wealth. Their "pile" is made: henceforth let others labor for them. In their relations with the laboring classes they too often show a masterfulness bordering on tyranny. The conditions of business, they will perhaps say, if for a moment anything in the way of an excuse seems needed, make it necessary to be very authoritative and absolute in dealing with those whom they employ. Perhaps so, but all the same the situation is not a good one; for, just in proportion as relations of sympathy cease to exist between employer and employed, does the rich man rely more and more upon the power of his wealth, and the poor man look upon wealth as the one thing that counts in differentiating human beings from one another. In his idea it is not the "boss" who makes the wealth, it is the wealth that makes the "boss."

That the daily press greatly tends to intensify the all but universal worship of wealth is obvious to every reader. Everything is measured and discussed in terms of money. Other things, such as literature, art, science, and religion, are treated as the non-essentials: money is the essential. To express it otherwise, the former are all partial—some of them very partial—interests; money is the universal interest. The Armenian atrocities awoke much apparent and some real indignation; but how much action did they set in motion compared with the discovery of gold on the Klondike? The whole political movement of the country is based on money considerations. The offices which still remain within the politician's grasp are the mainspring of all his efforts, while those which the civil-service law has removed from his control give him the feelings which a bird seen through a closed window gives to the necessary cat. Popular education, too, is laid out upon lines which point to the supremacy of money as an object of human desire. Not first the health of the body or the health of the mind, or the harmony of the human faculties, or the right ordering of the affections, but first the preparation for grasping money. And so our schools turn out into the world annually vast multitudes of would-be money-graspers—though many of them are none too well prepared even for that function—and an extremely limited number of individuals who have imbibed any true mental or moral culture as the result of from five to ten years' alleged education.

The extraordinary amount of attention bestowed upon sport and other forms of amusement in the

present day can not be considered a favorable sign. Open-air sports, no doubt, conduce to physical development; but it may be questioned whether the interest which they inspire arises from any sense of their importance in this respect. Local rivalries and the spirit of faction have much more to do with it. Another point is that talk about sport is the easiest kind of talk for empty minds; and what floods of it are sweeping the land to day no one needs to be told. Considering the wealth of matter for conversation which the modern world affords, it is lamentable to think how many households among the comfortable classes seem almost incapable of discussing any other subject morning, noon, and night than games of one kind and another and the "records" made by pitchers, batters, throwers, runners, kickers, and sluggers. People of presumed education, who will only scan the head lines of the news in regard to important social and political movements, will read every line of the prolix reports devoted to the doings of the sporting world. In the language of the day a match between two football or hockey clubs is an "event." All this means, we do not hesitate to say, a hurtful amount of mental dissipation; and it means also, we fear, the cultivation of idle habits. To what extent the work of our educational institutions is impaired by the undue devotion of the young to sports, many leading educators are prepared to attest. It is not, they will say, the time actually spent upon games that counts against study, so much as the everlasting occupation of brain and tongue with the discussion of games. It is there the evil lies.

Here again we see a result of the material advance of society. People are more self-indulgent because they have the means of being so. They give more time and thought to amusements, because amusements are continually being brought to their very doors, and in a hundred ways forced on their attention. And yet there is a residuum in society that knows little of amusement. There is even a section of the community that lives below the level at which amusement is possible. A race enervated by self-indulgence is not in a fit condition to grapple vigorously with its social problems, and yet social problems too long neglected may take on some day a very alarming form. It is evident that there is much for serious-minded men and women to do to prevent an actual degeneration of character and intellect in our time. We want new and higher social ideals, and the question is how to create them. We want to destroy the fascination of mere money. We want more of equality in the community and less of caste; but the equality, or the approach to it, should be produced by a leveling up of those who are now below a decent standard of culture, not by any debasing of those who have reached such a standard. We want, of course we want, a purer tone in our politics; and that we can not have till those who make the politician are imbued with some sense of public duty. There are hundreds of agencies for good at work in the land; but many of these condemn themselves to partial sterility through the comparative narrowness of their aims, and sometimes through the exaggeration of language with which they urge their special reforms. It is human nature at large that wants uplifting; and if the light is in the world—as it is—the light of reason, of truth, of charity, why may we not hope to make it shine more widely, and so create for ourselves a social state whereof we shall not need to be ashamed?

Scientific Literature.

SPECIAL BOOKS.

We know of no man better fitted to deal with the Scientific Aspects of Christian Evidences* than Professor Wright. He is both a man of science and a theologian; a trusted professor in an orthodox seminary who is at the same time a fearless investigator of the geological record and of the antiquity of man—and even a sturdy advocate of Glacial man. He is thus bound by the very nature of his attitude to give fair and even attention to both aspects of the question he sets out to discuss. He begins by admitting that Christianity is not capable of demonstrative proof, and is open to objections not easy to answer; but, he retorts, it is not alone among well-founded beliefs in being thus situated. In a large number of cases it is unreasonable to demand such proof. From a philosophical point of view, even modern science is more superficial than it is popularly represented to be, and has often to assume and even depend upon data that it can not prove or even comprehend. Its great advances have in reality only slightly touched the true basis of religious hope and aspiration. After showing that there are limitations to scientific thought and enumerating some of the paradoxes which science has to encounter in basing its fundamental principles, Professor Wright defines the view of God's relation to Nature most generally held by Christian philosophers as being that the operations of Nature go on in the main by virtue of forces communicated in the beginning but subject to insulated and systematic interpositions expressing the divine will. This leads to the question of miracles, of which "the economy of the strictly miraculous element in the Bible can never cease to be a surprise to the scientific students of human history." Such events as the Flood, the passage of the Red Sea, and the destruction of Sodom and Gomorrah are accounted for as having been brought about by the regular operation of natural laws, while the miraculous element in them lay in the co-ordination by which they were made to concur with other incidents to produce a special result. Concerning the grand culminating miracle of the wonderful life and the death and resurrection of Christ, it is shown that an unbroken chain of evidence exists from eyewitnesses down; and it has been re-enforced by very recent discoveries of documents composed by authors removed by at most only a single life from the possibility of personal communication with eyewitnesses. While these evidences, as well as evidences of the accuracy of Old Testament history, have always been ample, the author now finds them superabundant. "The question, then, which we are brought to face [concerning the story of Christ] is, Were the Christians of the first century under a delusion?" To this the last pages of the book are devoted.

The amusement and interest of watching a child's gradual initiation into the mysteries of "things" is best known to the "better half" of the community. But even our mothers do not properly appreciate that with this entertainment may be gathered much information of scientific value—of value

* Scientific Aspects of Christian Evidences. By G. Frederick Wright. New York: D. Appleton and Company. Pp. 362. Price, $1.

not only for use in the bringing up of other children, but also because of the light which it may throw on the more difficult problems of general psychology. These thoughts have been brought to mind by a reading of Dr. Sully's Children's Ways.* The book consists of selections from the author's recently published Studies of Childhood. The somewhat abstruse discussions and the tcchnical language of the psychologist, which were present in the first work, have been done away with, and the style and subject-matter adapted to the needs of the general reader. The book may perhaps be summed up imperfectly as a popular study of the various instincts, emotions, and habits of mind of the average child as exhibited in the several stages of his progress to a realizing sense of his true relation to his surroundings. The results and dangers of certain thoughtless modes of treatment and early education, and the means which should be taken for eliminating, as far as possible, the numerous barbarous atavisms which are manifested in the human *young one* are pointed out. Regarding the much-discussed question of the moral nature of the child, Dr. Sully very happily says: "So far from saying that child nature is utterly bad or beautifully perfect, we should say that it is a disorderly jumble of impulses, each pushing itself upward in lively contest with the others, some toward what is bad, others toward what is good. It is on this motley group of tendencies that the hand of the moral cultivator has to work, selecting, arranging, organizing into a beautiful whole." Some amusing stories, which are told as illustrating various typical characteristics of childhood, form a charming adjunct to the more strictly practical text. The book is extremely interesting reading, and should prove suggestive and instructive, especially to mothers, who are as individuals most unfortunately prone to look on the latest comer as simply "my baby," and to lose sight of the future in the immediate emotional pleasure of pleasing him. Dr. Sully suffers somewhat from this same fault of over-enthusiasm, occasionally allowing his interest to get the better of his judgment; but many will consider this a happy fault in these extremely practical days. On the whole it seems to us that this condensation of the "Studies" was well conceived, and that if it gains the circulation its importance deserves we may look to see a marked improvement in the observation and training of children.

A better characterization can hardly be made of Mr. Means's sober book on Industrial Freedom † than that given by Mr. Wells in the introduction which he furnishes to it. Its aim, he says, is to show that no good can come out of the proposals that are made for legislative interference between employer and employed or out of socialistic schemes. "The author considers the existing methods of distributing the products of human activity by means of the wages system, and demonstrates that it tends to establish working people in a state of independence rather than of subjection; to promote industrial freedom and not to produce 'industrial slavery.' He shows how intimately the welfare of laborers is connected with the prosperity of their employers, and how the attempts to diminish the wealth of corporations may diminish the fund of capital out of which laborers are

* Children's Ways. By James Sully, M. A., LL. D. New York: D. Appleton and Company. Pp. 193. Price, $1.25.

† Industrial Freedom. By David MacGregor Means. With an Introduction by the Hon. David A. Wells. New York: D. Appleton and Company. Pp. 248. Price, $1.50.

paid. He points out the dangers that arise from the misapplication and abuse of the taxing power, and indicates the peculiar evils to which such abuses will lead under our form of government." The complaint for which the schemes in question are offered as a remedy is defined by the author as being that after all proper allowances are made the differences in the distribution of the comforts and enjoyments of life are excessive and unjust. The argument opposed to this idea recognizes the fact that socialism implies the surrender of the freedom of the laborer, with the expectation that it will be more than made up for by the increase of his compensation. Existing conditions and relations are then surveyed to find whether any substitute for the existing organization can be adopted that will work better. If not, "meddling will cause more injustice than it will remove." Besides the relations of individual employers and corporations and their employed, monopoly privileges, the partnership theory, the limitation of the rate of wages, and the nature of profits and the effects of reducing them are reviewed. Social improvement must come, ultimately, through the increase of integrity and honesty among men. Honesty will not be likely to increase when the principle of regard for property and respect for existing rights ceases to be cherished. Conscientious and cultivated men are warned of the responsibility that rests upon them. The movement toward the establishment of socialism will leave ineradicable traces in the shape of laws that can hardly be repealed, institutions that will be permanently mischievous, and debts that will burden children yet unborn. The greatest danger that threatens our republic lies in this tendency.

GENERAL NOTICES.

THE authors of the *Manual of Bacteriology* * are both university lecturers; Mr. Muir on pathological bacteriology at Edinburgh, and Mr. Ritchie on pathology at Oxford. They explain that the science has become so extensive that in a book of this size the treatment must be restricted to some special departments, or it will be superficial. The present work being intended first for medical students and practitioners, they have considered in it only those bacteria associated with disease in man. The effort has been made to render the work of practical utility for beginners, and elementary details have been given in the accounts of the more important methods. The evidence of certain bacteria having ætiological relationships with corresponding diseases, the general laws governing their action as producers of disease and the effects of various modifying circumstances are considered. The subject is treated under the heads of general morphology and biology of bacteria, methods of cultivation, nonpathogenic micro-organisms, the production of toxines, suppuration and allied conditions, the relations of bacteria to disease, and, in detail, the more important diseases in which they have been proved to make their effects felt. In the appendix four diseases—smallpox, hydrophobia, malarial fever, and dysentery—are treated of, in two of which the causal organism is not a bacterium, while in the other two its nature is not yet determined.

Amid the countless impressions which crowd upon the brain, not only by every avenue of sense, but also in connection with organic action, it is not to be wondered at that a large number should escape our recognition. These are faithfully registered, however, no less than the ones to which we attend and in time form a background of memory, a *Subconscious Self*,* which may influence or

* Manual of Bacteriology. By Robert Muir and James Ritchie. With 108 Illustrations. Edinburgh and London: Young J. Pentland. New York: The Macmillan Company. Pp. 519. Price, $3.25.

* The Subconscious Self and its Relation to Education and Health. By Louis Waldstein, M. D. New York: Charles Scribner's Sons. Pp. 171. Price, $1.25.

control the individual. Dr. Waldstein shows how this can be roused to activity by the repetition of some impression, an unobserved odor, a sound, or familiar surrounding, and create in us an emotion, or mood, for which we can not otherwise account. Likes and dislikes, antipathies, "love at sight," even religious feeling may be the offspring of this subconscious self. In the earlier years of life, before consciousness is fully developed, it has its largest growth. It is important, therefore, that the impressions received by the young be carefully guarded. As nervous disorders spring from the predominance of this hidden nature, the inhibiting will and judgment must be cultivated. "It is in every case a grave risk to delegate the educational and directing powers of a mother to any stranger." Life in the country supplies the best conditions for the child. To the subconscious self it furnishes the impressions of restfulness and singleness of purpose, while the conscious intellectual activity is exercised in learning to distinguish the differences in natural objects. In the opinion of the author, the subconscious self is always the basis of the æsthetic mood, and not only in a receptive fashion, empowering us to enjoy music, art, and poetry, but it is also responsible for the creations of genius. He enters here upon debatable ground, for the assertion that "Shakespeare perceived without effort great truths through the subconscious self" is somewhat contradictory. Perception involves classification and implies consciousness. Several antitheses are brought forward which are probably merely casual. That between music and mental analysis suggested by Charles Darwin is amply disproved by the case of Chauvenet, distinguished mathematician and musician; also that "careful observers and those of analytical habits can not abide perfumes" is equally doubtful. It is certainly unscientific to connect two coexistent characteristics as cause and sequence when no causative relation has been proved. The author suggests that "heredity" is often invoked to account for habits that are the effects of early impressions or mimicry. This is credible where there has been contact, but not where a generation has intervened. Neither are inherited tendencies "unalterable," "beyond our influence." If recognized in time they may be modified even as the character of leaves may be changed by varying food and temperature, or seedless oranges produced by culture.

This work,* forming a supplement to the *Journal of Morphology*, vol. xii, No. 2, is the outcome of ten years' study of protoplasmic structure in the Protozoa, Metazoa, and higher forms of life. The author made her observations upon living material although comparing it with various "proserved" forms, and concludes that the original delicacy of structure is altered by the reagents commonly used. One object, therefore, of publishing her researches is to induce the biologist to observe the living substance as the naturalist studies the habit of an organism. Acknowledging her indebtedness to Bütschli's work, she claims that the structure known by his name is not the final constitution of the protoplasmic foam, but only one of a graded series yet undiscovered. She finds that there is not only an external environment, but an internal one which the living substance is ever seeking to control, to render itself more independent. As the result of her investigations, a new biological standpoint is offered, that the true organism is the invisible vesicular substance; all powers, functions, and organs are primarily for this, and only incidentally for the animal and plant. Reflex actions are noted as pointing toward this view, in establishing the fact that activities seemingly of the organism are products of local function. Man thus finds himself but a secondary affair, a mere phase of protoplasm, and it is unquestionably "difficult to overcome the natural egotism of the unit" and persuade him of this as truth without many more facts than are brought forward in the present volume. The plea, however, that the phenomena of life is best observed in living protoplasm is well founded and supported by the circumstance that the chemical properties of dead and living cells are unlike, shown in a pamphlet by Prof. Oscar Loew.†

The *Eleventh Annual Report of the Commissioner of Labor*, 1895–'96 (Washington, Government Printing Office), comprises the results of an investigation relative to the

* The Living Substance, as such and as Organism. By Gwendolen Foulke Andrews. Boston: Ginn & Co. Pp. 176. Price, $1.50.

† Popular Science Monthly, vol. li, p. 711.

comparative employment of men, women, and children at two periods of time, and is made in accordance with a joint resolution of Congress. The work now being performed hy the department is more varied and extensive than at any other period of its existence. It includes an investigation relating to the effect of machinery upon lahor and the cost of production; a report npon wages paid in leading countries; inquiries into various aspects of the liquor traffic; and inquiries relative to the municipal ownership of gas, electric, and motor plants; to the condition of the Italians of Chicago; and into the economic progress of the negroes.

The *Journal of Osteopathy* is a periodical devoted to osteopathy, or a new system of healing without drugs, which seems to have found favor with considerahle numhers of people, and has heen recognized hy law in four States. It is puhlished monthly at the American Institute of Osteopathy, Kirksville, Mo., at $1 a year.

The Story of Oliver Twist, condensed for home and school reading, hy *Ella Boyce Kirk* (Appletons, 60 cts.), has recently come to us. It is part of a series of "home-reading hooks" designed to supplement the ordinary school work of the child, and is one of the results of what was originally the university extension movement, hut which could now more appropriately he called the school-extension movement, as its principles have heen applied all along the line down almost to the kindergarten. The author thus describes her hook: "I have tried to present one of Dickens's most popular stories as nearly as possihle in the form (judging from his Child's History of England) that he would have put it if he had written it for young readers. I have used his language, I have not presumed to change or modify his expression, hut everything that a child would he likely to skip has heen elided. The action is thus accelerated to suit the most impatient reader."

Education from a Publisher's Standpoint, an address delivered hefore the National Educational Association on July 7th, hy Mr. *Gilman H. Tucker*, takes the ground that the work of the publisher is closely hound up with that of the teacher, and that co-operation and sympathy are the necessary watchwords. Mr. Tucker is Secretary of the American Book Company, and hence an authority on text-books. The address is pnblished in a small pamphlet of twenty-three pages.

In *The Mother's Council*, or the Kindergarten in the Nursery, Mrs. *Louise Pollock* attempts to arrange a course of mental and physical training for nse hy the mother or nurse in the nursery. It is hased on Froehel's Mother Book of Song and Play. The applications hegin when the child has reached the age of three months; the first one consisting of the swinging of a yarn hall in front of the child's face, and singing the following inspiring melody:

> Here, there, here, there,
> Coming, going,
> Forward, backward,
> The little ball comes, it goes.

The hook also contains a numher of "Educational Rules," the first of which is, "Be careful what hahits a child acquires during the first month of his life. Do not rock or walk him to sleep, unless you wish to do it for years to come." This is undouhtedly good science, hut rule 29, which follows, is somewhat douhtful in this respect. "If the house is so constructed that you can not conveniently have your head to the north while sleeping, the next hest way is to sleep with your feet to the west. The electrical currents come from the east, and it is hest they should reach you from head to foot, rather than *vice versa*."

The American X-Ray Journal, monthly, *Heber Roberts*, M. D., editor, is devoted to practical X-ray work and allied arts and sciences, with special reference to the physical improvement of man. Published at St. Louis, Mo., $1 a year.

The *Annual Report of the State Geologist of New Jersey* for 1896 contains the reports of progress hy R. D. Salishury and G. N. Knapp on the survey of the surface formations, and of H. R. Kümmel on the Newark system or New Red Sandstone; and reports hy J. E. Wolff on Archæan Geology (Sussex County), Lewis Woolman on Artesian Wells (Stratigraphy of the Fish House Black Clays); C. C. Vermeule on the Flood of February 6, 1886, in Northern New Jersey; C. C. Vermeule on the Drainage of the Hackensack

and Newark Tide Marshes; G. F. Jenkins on the Iron Mining Industry; and John Gifford on Forestry in Holland, Germany, Switzerland, and France; with mineral statistics. The reports are accompanied by excellent maps.

The last volume in Appletons' Home-Reading Series to reach us is entitled *Curious Homes and their Tenants*. It consists of a popular description of some of the more curious human and animal "homes." The author, *James Carter Beard*, disclaims any attempt to do more than attract the attention of his readers to the subject in the hope of awakening in them the desire for a more thorough acquaintance with an interesting and instructive study. As the chief function of the animal or plant seems to be the perpetuation of species, we may expect the highest and most perfect qualities and instincts to be manifested in the solution of the cares and duties of parentage. To give some idea of the scope of the book we take the following chapter headings: Cave Dwellers, Birds that build Edible Nests, Moles, Jumping Mice, Bees and Wasps as Miners, Ants at Home, Cliff-dwellers, Butterfly House, Human Nest Builders, Eskimo Homes, Human Lake-dwellers, A City of Birds. Illustrations are numerous and well chosen.

The purpose of the work *Opposites of the Universe* is explained by the author, *Mamie Sands*, as to demonstrate that the universe is a whirl of opposites, and that these opposites are eternal, "which implies that they are neither creatable nor destroyable when the whole kosmos is considered." The book is to be in six parts. The first part, now before us, is a Discourse about Immortality, in which "opposites in special" are considered. They are arranged under numerous headings, such as chemiological, astrological, electrological, etc., opposites; and the theses are enforced by citations from philosophical and other writers of all ages. (Peter Eckler, New York, publisher. Price, 50 cents.)

Mr. J. Wilson, in common with most of his human brothers, is not satisfied with the present management of "things," so he has written a book on the rights and wrongs of men, under the title *Self-control, or Life without a Master*. He states its aim to be the bringing of the reader to a realizing sense of the fact that "no man has a right, under any circumstances or under any conditions, to be the master of another man." He contends that under the existing order the child is a slave to his nurse, then to his parents until he is twenty-one, and from this time until his death to the state. "He does not believe in masters or governments in any form." He claims no originality for his thoughts; "he would not deny for a moment that such thoughts have come or will come to other men." And further he says: "If the reader has not full confidence in his" (the author's) "ability to discuss this question fully and fairly, and if he is not confident that the author knows just what he is saying and what he is talking about, he ought to select some other book for perusal," which is certainly fair enough. The closing paragraph of the volume contains the following prediction: "What happened in Paris in the eighteenth century is liable, I may say is certain, to happen in America some time during the twentieth." (Lemcke & Buechner, New York.)

We have received from C. W. Bardeen (Syracuse) *A Government Class-book of the State of Michigan*. It is a review of the form of State, county, city, and township government which prevails in Michigan, stating the function and powers of the various governing bodies and officials, and containing as two appendices the Constitutions of the State of Michigan and of the United States.

Not In It, by *Anna Olcott Commelin*, is a story intended to show the obligation under which the rich man is to aid his poorer neighbors. It recounts the history of several individuals in varying conditions of life, showing the value of well-timed aid and the great suffering which poverty entails on those who are suddenly reduced to it from comparative wealth. (Fowler & Wells, New York, 75 cents.)

The first series of lectures by A. D. Waller on physiology, which was delivered at the Royal Institution in the spring of 1897, has just appeared in book form under the title *Animal Electricity*. The material consists of six lectures. The first is a demonstration of the phenomenon of animal electricity, the

second describes the methods of experimentation, and the remainder deal chiefly with experiments bringing out the various laws and phenomena which have thus far been ascertained. The printed lectures contain considerable matter which was not considered appropriate for the popular lectures, "but which is nevertheless essential to the further study of the subject." Three of the lectures in the original course on the action of nitrous oxide are not included, but are announced as reserved for a "second series." There are a number of explanatory disgrams and illustrations. (Longmans, Green & Co., New York. $1.50.)

The arguments in favor of the vertical system of handwriting have been set forth in the Popular Science Monthly. We are glad to see that it is attracting the attention of publishers of school books. One of the simplest and most convenient applications of it is made in *The Natural System of Vertical Handwriting*, by *A. F. Newlands* and *R. K. Row*, which is published by D. C. Heath & Co. The authors are represented to have been the first to advocate the new system in America, and to have made the first and longest-continued experiments in it. With them legibility is the first consideration, and they believe that handwriting should be as much as possible like print, consistently with convenient manipulation. The course consists of six books of progressive lessons, presenting a beautiful, plain, open hand, to which two books of social and business forms are to be added.

Stewart's Telegraphic Code consists of a system in which numbers are represented by combinations of letters. Telegraph companies in transmitting numbers charge for each figure as a separate word. By means of this system Mr. Stewart represents any number from 1 to 999,999 in a word of ten letters or less. For instance, 74,013, which, if sent as it stands, would be charged for as six words, is in the system represented by "rulidoka," which would, of course, go as one word. (Author, St. Paul, Minn.)

PUBLICATIONS RECEIVED.

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Bailey, L. H. Lessons with Plants. New York: The Macmillan Company. Pp. 491. $1.10.

Björnling, Philip R. Whittaker's Mechanical Engineer's Pocket Book. New York: The Macmillan Company. Pp. 377. $1.75.

Brown, John. Parasitic Wealth; or, Money Reform. Chicago: C. H. Kerr & Co. Pp. 169. $1.

Bulletins and Reports. Department of Labor, January, 1898. Pp. 140.—New York State Museum, October, 1897. On Road Materials and Road Building. Pp. 134, with maps.—Bureau of American Republics, January, 1898. Pp. 180.—Report of the Bureau of Labor Statistics of Connecticut for 1897. Pp. 240.—Report of the Director of Physical Training in Public Schools of Washington, D. C., 1896-'97. Pp. 22.—Report of Public Schools of the District of Columbia, 1896-'97. Pp. 305.

De Witt, T. H. Benton. A Correspondence between an Amateur and a Professor of Political Economy. Philadelphia. Pp. 19.

Evans, E. P. Evolutionary Ethics and Animal Psychology. New York: D. Appleton and Company. Pp. 386. $1.75.

Gosse, Edmund. A Short History of Modern English Literature. New York: D. Appleton and Company. Pp. 416. $1.50.

Janus. Archives Internationales pour l'Histoire du Médecine et pour la Géographie Médicale (International Archives for the History of Medicine and for Medical Geography). Bimonthly and Polyglot. Dr. H. F. A. Peppers, Editor. Amsterdam, September 20, 1897. Pp. 200.

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Journal of Applied Microscopy. Monthly. Vol. I, No. 1, January, 1898. Rochester, N. Y.: Bausch and Lomb Optical Company. Pp. 14. $1 a year.

Kellicott, David S. The Dissection of the Ophidian. Columbus, Ohio. Pp. 72.

Lockyer, Sir Norman. The Sun's Place in Nature. New York: The Macmillan Company. Pp. 360. $2.75.

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Ober, F. A. Crusoe's Island. A Bird-Hunter's Story. New York: D. Appleton and Company. Pp. 273. 65 cents.

Reprints. Bessey, Charles E.: Some Considerations on the Functions of Stomata. Pp. 3.—Brigham, A. P.: Present Status of the Electric System in American Colleges. Pp. 10.—Closson, Charles C.: The Hierarchy of European Races. Pp. 14.—Dellenbaugh, F. S.: The True Route of Coronado's March. Pp. 32.—Jastrow, Joseph.: The

Life of a College Professor. Pp. 8.—Lumholtz, Carl: The Huichol Indians of Mexico. Pp. 14, with 2 plates.—McReynolds, John O.: A New Phorometer. Pp. 7.—Quantz, J. O.: Problems in the Psychology of Reading. Pp. 51.—White, Theodore G.: A Contribution to the Petrography of the Boston Basin. Pp. 40, with plates.—Udden, J. A.: Loess as a Land Deposit. Pp. 8.—Ward, Lester F.: The Essential Nature of Religion. Pp. 24.—*Contributions to Hopkins Seaside Laboratory, Stanford University:* Geology of the Palæozoic Area of Arkansas South of the Novaculite Region. By G. H. Ashley. Pp. 102; Scientific Names of Latin and Greek Derivation. By Walter Miller. Pp. 32; A Morphological Study of Naias and Zannichella. By D. H. Campbell. Pp. 64, with plates; The Development of Glyphioceras and the Phylogeny of the Glyphioceratidæ. By J. P. Smith. Pp. 28, with plates.—*United States Commission of Fish and Fisheries:* The Fishes found in the Vicinity of Wood's Hole. By Hugh M. Smith. Pp. 30, with maps.—Salmon Investigations in the Columbia River Basin, etc., in 1896. By B. W. Evermann and S. E. Meek. Pp. 72; The Fishes of the Klamath River Basin. By C. H. Gilbert. Pp. 13.—*United States National Museum:* New Species of Coleoptera, etc. By M. Q. Linell. Pp. 14; Notes on Trematode Parasites of Fishes. By Edwin Linton. Pp. 50, with plates; Notes on a Collection of Fishes from the Colorado Basin in Arizona. By C. H. Gilbert and N. B. Scofield. Pp. 12, with plates; New Mammals of the Genera Sciurus, Castor, Neotoma, etc. Pp. 7.

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Fragments of Science.

The Effect of Trade Unions on Individual Advance.—The growth of a country in civilization and wealth depends chiefly on the efforts of its individuals. The great advances in modern science and industry have been made by men a little ahead of their neighbors in clear-sightedness and push. Hence, anything which puts a curb on individual effort and ambition is antagonistic to the best interests of society and civilization. The trade union, which in its inception had only a co-operative function, enabling the men in a given trade to help one another in cases of injury, sickness, etc., and to meet representatives of other industries for furthering trade relations and association, has in the modern industrial world assumed quite a different function, whose worst manifestation is the stifling of whatever individuality and push the workman may have, and forcing him to limit his work to that of the least efficient of his fellows. The fact that Brown can do in a day half as much more work than Jones, and do it better, is an item which if known is not considered unless he does it, in which case he is informed that he is doing too much and must "let up." The official amount is prescribed, and no one, whatever his ability, is expected to exceed that. There can be only one result of a system which discourages a man's doing his best, and limits him to the capacity of the poorest workman in the union, and that is to destroy individuality and ambition, the two most powerful forces which work for human advancement. That such is the real effect of the trade union has recently received additional confirmation by the statements of a skilled mechanic who has actually "been through the mill" and risen from the ranks. In the November number of the Engineering Magazine, Mr. Hiram S. Maxim, widely known for his important industrial and scientific work during the past fifteen years, and who began his career as a common hand in a machine works in Fitchburg, Mass., writes on the subject of trades unions. He shows that in every instance the effect of the union is to decrease the work, both in quantity and quality, demoralize the workman, and foster a tendency to soldiering and dishonesty.

The Metals of Canada.—In his address at the British Association on the Metals of Canada, Prof. Roberts Austen showed that the recognition of the extent and variety of the mineral wealth of the Dominion had been comparatively recent, and the development of the related industries slow. This was due partly to the policy pursued by the Hudson Bay Company of keeping the country wild for the sake of the fur-bearing animals; partly to ignorance in the mother country of the resources of Canada; and partly to the difficulty of access to the mining districts before the railroads were built. In speaking of the Dominion generally, the richness of the deposits and the hopefulness of prospects must be kept in view rather than the immediate output; but it should be remembered

that since the meeting of the British Association in Montreal in 1884 the mineral production of the Dominion had more than doubled. The principal metals of Canada are gold, silver, nickel, copper, lead, and iron; besides these, manganese, chromium, antimony, and zinc occur, with platinum and rarer metals. The gold is at present obtained from the provinces of British Columbia, Ontario, and Nova Scotia. In Ontario, discoveries of this metal have been made over an area of about two thousand square miles, in a tract one hundred miles wide and two hundred miles long. As for silver, the Slocan mines and those of Trail Creek and East and West Kootenay appear to be of extraordinary richness. The lecturer dwelt at some length on the importance of the resources of Canada in iron and steel, and mentioned nickel, which greatly affects the quality of steel, as a metal the importance of which it is impossible to overestimate, and chromium as a metal with which the manufacturer of projectiles would probably triumph over the man who put nickel into his steel armor.

The Cruelties of Antivivisectionists.—Dr. Charles Minor Blackford, after reviewing the present position and needs of pathology in an address on that subject before the Medical Society of Virginia, spoke of a danger as confronting it which has passed away from every other science. Prof. Andrew D. White, he said, "has lately given us a history of The Warfare of Science, in which he has told, plainly and simply, the story of the army of martyrs to scientific truth, and his record is one that may well make us blush for humanity. It is true that we no longer have to fear the stake and rack in investigating Nature, but, though life and limb are safe, the same spirit survives in other forms. A number of persons, whom, for the sake of our civilization, we will assume to be well intended, are striving in many ways to oppose freedom of thought as much now as in the fifteenth century. They lay great emphasis on the commandment 'Thou shalt not kill,' but ignore 'Are ye not worth many sparrows?' Assuming a number of facts that they are unable to prove, they endeavor to make those whose lives are devoted to saving life and relieving pain appear the most cruel of wretches. Never having seen the interior of a laboratory, they erect an imaginary one, and coolly assert that the scenes that their own imaginations have conjured up go on in them, and at their meetings vote resolutions condemning physiologists for attempting to save life, and legislatures for forbidding the wearing of our song birds on their hats. In our climate there are not five days in as many years that it is necessary to wear furs for shelter from cold, yet two of the greatest nations of the world have been on the brink of war for some years past, and a harmless and beautiful race of animals have been wellnigh exterminated to supply what is purely an article of vanity and luxury. To supply the 'aigrettes' worn on woman's bonnets, female herons have to be killed at a time when the death of the mother means the death of her brood; and yet when a British Humane Society appealed to the leader of the British fashionable world to give up this senseless and cruel ornament, it met an abrupt refusal. Similarly, the American bison has been exterminated to gratify vanity; the same fate awaits the elephant; and, I will venture to say, the pain endured by geese to supply the 'live-goose feathers,' and by horses in having their tails docked and in wearing the 'kimble-jack'—both thoroughly useless affectations of fashion—is greater than that endured by any animals in a laboratory. In this latter case, not merely do the horses have to endure, *without an anæsthetic*, cutting through a highly nervous part, but they are rendered defenseless from the attacks of flies and other insects by the loss of Nature's weapon, and are forced to drag heavy vehicles at high speed with the head held in an unnatural position by a rough bit in the tender mouth. We can picture the members of antivivisection societies driving to their meeting with horses so mutilated, removing their sealskin coats and aigretted bonnets, and denouncing attempts to find a cure for diphtheria.

> "'Oh, wad some power the giftie gi'e us
> To see oursel's as ithers see us!'"

Economical Experiences in Canada.—In a study of certain characteristics of the history of economics in Canada, presented to the British Association, Prof. Adam Scott describes this history as having been, up to the beginning of the present century and for

some time afterward, mainly a record of numerous governmental experiments covering the leading features of economic life. The results were mostly of a negative character, but were valuable for the student. Study of the conditions in French Canada should he accompanied by a study of the conditions that prevailed in France, England, and the English colonies. The differences between the colonies were due not so much to their location, their race, or their products as to the regulations hy which they were controlled. The French hureaucratic system, with its tendency to minute interference with every aspect of social life, was opposed in New England hy a system which left to the colonists the utmost liberty in the practical direction of their affairs. Much good was accomplished in Canada under the influence and direction of Colhert, hut as much or greater harm was done hy incompetent administrations later. In Canada despotism was tempered hy access to the woods, those too heavily hurdened readily taking to the ways of the savages, a fact that gave the French an influence upon the Indians greater than could have been expected, inasmuch as their pecuniary advantages lay almost altogether with the English. Although in theory the English colonies were dependent for all things upon the home government, they were largely left to themselves, and when George III thought to atone for past neglect hy vigorous administration it was found that the lapsed authority could not he recovered. Thus, while in Canada a colony had grown up dependent on European influences, the English colony had hecome accustomed to look to itself for all things. The whole study was presented as emphasizing the necessity in theoretic economics of keeping in mind differences in conditions and in their range of operation and influence.

Singing Flames.—In a recent numher of the American Journal of Science, Mr. H. V. Gill has an interesting paper on The Theory of Singing Flames. The phenomenon of a gas jet hurning inside an open tuhe, emitting a musical note, is one of those facts which, although known for many years and much written ahout, has never heen fully explained. Among the more interesting theories was that of De la Rive, who supposed the sound to be due to a periodic condensation of the water vapor produced in the comhustion of hydrogen gas. Faraday showed the inadequacy of this theory hy the use of a flame which did not form water vapor, and proposed in its stead the theory that the so-called singing was caused hy successive periodic explosives of a mixture of gas and air. This was accepted hy Tyndall. Another theory which has heen proposed is that the sound is produced hy vihrations maintained hy heat, the heat being communicated to the mass of air confined in the sounding tube at a place where in the course of vihration the pressure changes. Sondhauss performed a series of experiments, his chief conclusion heing that the condition of the column of gas in the supply tuhe had an important influence on the phenomena. Mr. H. V. Gill sums up his conclusions as follows: "We think we have made it clear that the pressure on the gas plays the important part in this phenomenon, and that a consideration of the reactions we have described will be found to explain the many facts noted in the case of a singing flame, some of which we have alluded to. We look, therefore, on the chief cause as a mutual reaction between the pressures in the tuhe and on the gas, the energy necessary to sustain the note heing supplied hy the pressure on the gas and the action of the flame. We may compare the singing flame to the siren, in which the current of air causes the disk to rotate, the note being produced hy the reaction of the disk on the current of air. . . . We have, then, three kinds of singing flames, one depending on changes of pressure, another on air currents, and a third depending at once on hoth changes of pressure and on air currents."

Sanitariums for Consumptives.—The urgent need of sanitariums for the consumptive poor in our large cities was forcihly presented by Dr. S. A. Knopf in a paper which he read before the American Puhlic Health Association in Octoher, 1897. The author shows, in the first placc, that the homes of these invalids are as unsuitahle as they can he for their proper treatment; that with them their families and fellow-tenants are sure to he infected, and the neighhorhood is in danger. Neither can they properly he received in the general hospitals, where the

annoyance to other patients in the ward—always a great danger in itself and sometimes fatal to the patients—is added to the danger of communicating tuberculosis. They should be isolated. A number of instances are cited of special hospitals for consumptives maintained by private enterprise, to show that patients can be cared for economically at such institutions, and with a success according to the stage of the disease when they are taken there. At St. Joseph Hospital, New York, fifteen hundred far-gone cases are cared for annually at an average cost of fifty cents a day. At Saranac Lake, where incipient cases are taken, from thirty to thirty-five per cent are cured with an average stay of eleven months and ten days; at Liberty fifty per cent are improved after three months, and about twenty-five per cent are cured. At Sharon Sanitarium, near Boston, twenty-five per cent of "arrested cases" are reported. Other sanitary advantages of inestimable value to the community are mentioned as likely to accrue from the establishment of such sanitariums and their proper management. Patients will, for instance, receive there a proper sanitary education, and be drilled in sanitary practice, taking which to their homes, they will become educational factors in public hygiene. Dr. Knopf proposes to have these sanitariums controlled and maintained by States and municipalities. It would be well to have the infection of corruption removed from State and municipal politics before this is done.

Crater Lake, Oregon.—Crater lakes are defined by Mr. J. S. Diller as lakes that occupy the craters of volcanoes, or pits of volcanic origin. They are most abundant in Italy and Central America, regions in which volcanoes are still active; and they occur also in France, Germany, India, the Sandwich Islands, and other parts of the world where volcanic phenomena have been important in geological history. Only one is known in the United States, and that is in southern Oregon, in the heart of the Cascade Range. It is interesting to the geologist and inviting to the tourist and health-seeker. It is as yet reached only by private conveyance over about eighty miles of mountain roads from Ashland, Medford, or Gold Hill, on the railroad. The lake, which appears to be about the height of Mount Washington above the sea, is surrounded by a series of unbroken cliffs ranging from 6,759 to 8,228 feet in height, or from more than five hundred to nearly two thousand feet above it, which are clearly reflected in its deep-blue waters. The outer slope of this rim is gentle, while the inner slope is abrupt and full of cliffs. The rim crest is generally passable, so that a pedestrian may follow it continuously round the lake—a circuit of about twenty miles—with the exception of short intervals on the southern side. The inner slope of the rim, though precipitous, is not a continuous cliff, but is made up of many cliffs, whose horizontal extent is generally much greater than the vertical. Other elements of the inner slope are forests and talus, and these make it possible at a few points to approach the lake, not with great ease, but, if done carefully, with little danger. On arriving at the water's edge, the observer is struck with the fact that there is no beach. The steep slopes above the surface of the lake continue beneath its waters to great depths. "Here and there upon the shore, where a rill descends from a melting snow bank near the crest, a small delta deposit makes a little shallow, turning the deep blue water to pale green." Among the most salient features of the lake are Wizard Island and the Phantom Ship. Wizard Island embraces an extremely rough lava field and a cinder cone, from the base of which the lava has been erupted. The cinder cone is a perfect little volcano with steep, symmetrical slope, eight hundred and forty-five feet high, and surmounted by a crater eighty feet deep, and is so new and fresh that it is scarcely forested, and shows no trace of weathering. The Phantom Ship is a craggy little islet with features that suggest the name. "Aside from its attractive scenic features, Crater Lake affords one of the most interesting and instructive fields for the study of volcanic geology to be found anywhere in the world. Considered in all its aspects, it ranks with the Grand Cañon of the Colorado, the Yosemite Valley, and the Falls of Niagara."

The Enchanted Mesa.—An article in a recent copy of the National Geographic Magazine, by F. W. Hodge, gives an account of some interesting exploratory work done by

hlm in the valley of Acoma in central New Mexico. The *Katzimo*, or enchanted mesa, is an isolated mass of rock rising from the center of the plain to a height of four hundred and thirty feet. Native tradition has it that this was once tbe bome of tbeir ancestors, hut during a great convulsion of Nature, at a time when most of the inhabitants were at work in their fields helow, an immense rocky mass hecame freed from the friable wall of the cliff, destroying the only trail to the summit and leaving a few old women to perish on tbe inaccessible heigbt. This tradition has heen strengthened hy the finding of numerous fragments of pottery of very ancient type in the talus beneath the wall where it is said the path originally existed, and also hy traces of hand and foot holes for some distance up the side of the cliff. Professor Hodge, hy the aid of an extension ladder and several hundred feet of rope, after two hours' hard work, succeeded in reaching the summit of the mesa. The first recorded ascent was that of Professor Libby, of Princeton, in July, 1897. Several ancient potsherds and a curious sort of monument were the only archæological finds. Professor Hodge, however, drew a map of the surface and accurately determined its altitude.

The Age of Trees.—The following information is taken from a recent circular of the United States Department of Agriculture: In all the timber trees of the temperate portion of our country the wood of the stem is laid on in sheets, which on any cross-section appear as so many concentric rings. Generally these rings are sufficiently well defined to he readily counted, and since only one is formed during each growing season tbey furnish a very convenient record of the age of that portion of the tree. In the cross-section of a pine, fir, or cedar tbese rings appear as alternate narrow hands of lighter and darker color, the dark line, or "summer wood," occupying the outer portion of any one ring, and heing sharply contrasted against the lightest part of the inner lighter, or "spring wood." These rings are conspicuous through rows of pores, each row occupying the inner or spring-wood part of a ring and being separated from tbe row of pores of the next ring hy wood practically devoid of large pores. In the "diffuse porous" woods, like hirch, poplar, tulip, etc., the rings are generally less conspicuous, being defined by a mere line, often scarcely perceptihle in the fresh wood, and due to the fact that the outermost cells of the summer wood are always small, flattened in form, and have thick walls, while the adjoining innermost cells of the spring wood of the neighboring ring are much larger, not flattened, and always have thin walls. The growth of these rings is very even and regular, especially in young and thrifty timber, where the conditions for tree life are favorahle. Where the conditions are not good the ring formation varies in a number of ways, and is a not at all reliable source for obtaining the age of the tree. A cross-section from one to two feet ahove the ground should have added to the numher of rings found from five to seven years, as the seedling would prohahly have required that period to reach a height of two feet.

The Pitch Lake of Trinidad.—Some romances and exaggeratious of wbich tbe pitch lake of Trinidad has heen the suhject are corrected by Mr. Albert Cronise, of Rochester, N. Y. Its area, height, and distance from the sea have been overestimated, and a volcanic action has heen ascribed to it which does not really exist. It is one mile from the landing place, is one hundred and thirty-eight feet above sea level, is irregular, approximately round, and has an area of one hundred and nine acres. Its surface is a few feet higher than the ground immediately around it, having heen lifted up hy the pressure from below. The material of the lake is solid to a depth of several feet, except in a few spots in the center, where it remains soft, hut usually not hot or hoiling. But as the condition of the softest part varies, it may he that it hoils sometimes. The surface of the lake is marked hy fissures two or three feet wide, and slightly depressed spots, all of which are filled with rain water. In going about, one has to pick his way among the larger puddles, and jump many of the smaller connecting streams. Each of the hundreds of irregular portions separated hy this network of fissures is said to have a slow revolving motion upon a horizontal axis at right angles to a line from the center of the lake, the surface moving

toward the circumference. This motion is supposed to he caused hy the great daily change in temperature, often amounting to 80°, and an unequal upward motion of the mass helow, increasing toward the center of the lake. A few patches of shallow earth lying on the pitch and covered with hushes and small trees are scattered over the surface of the lake.

Nature's Landscape Gardening.—A curious and interesting and yet easily explainahle phenomenon is mentioned in a recent paper hy N. F. Drake, in the Journal of Geology, on The Topography of California. In assisting to map a numher of sand-dune areas along the coast in San Luis Ohispo County it was noticed that where the sand was free from vegetation or ohstruction it was piled in ridges at right angles to the prevailing sea hreezes; hut that where patches of vegetation grew, the dunes hecame parallel to the direction of the wind, and where the vegetation hecame thicker over the ground the regularity of the arrangement of the dunes was more hroken. The reversal of the direction of the ridges where patches of vegetation existed was accounted for as follows: A mass of grass or hushes once started would check the sand from moving at that point and make a shelter for deposits to the leeward. This point of the sand dune now heing more stahle, other plant growth would spring up—mainly on the leeward side, so as to lengthen and increase the elevation of the ridges, while the unprotected sands at either side would drift away, thus forming narrow parallel ridges in the direction of the prevailing winds. Ridges from fifty to seventy-five feet high and four to six hundred feet long, or even longer, were not uncommon where the sand dunes were extensive.

Pegamoid.—Pegamoid is a suhstance of similar composition with celluloid, possessing its desirahle qualities, while it is not inflammahle and does not lose shape when heated. It was discovered hy an English lithographer seeking a means of protecting the posters of his making from injury hy the atmosphere. Its composition is a secret, hut it appears to contain a nitrified cellulose, alcohol, and camphor, or the essential constituents of celluloid, together with some substances intended to increase its impermeahility and make it supple and uninflammahle. It may he applied in thin varnishes to any material—cloth, leather, paper, etc.—so closely that it can not be separated hy any mechanical means, and so as to form an impermeahle coating, easily cleaned hy washing, and proof against heat, grease, and alkalies, while it has the further property of communicating its qualities to the material to which it is applied without destroying its individuality. Pegamoid cloth is a cotton fahric covered with a suitahle thickness of pegamoid and gauffered. The process of manufacturing it is very simple, and consists in dyeing the cloth in the desired color, mechanically coating it with colored pegamoid, and stamping it. This is only one of the innumerahle applications of which pegamoid is capahle.

MINOR PARAGRAPHS.

THE method of reproduction of the eel, long a puzzle in zoölogy, has been discovered. Young eels were known, hut at too advanced a stage of development to give any clew to their primitive or larval state, and no eels in this condition had ever heen recognized. Theodore Gill suggested in 1864 that larval eels might he identified with the *Leptocephalus*, an animal which is found on the British shores, in the Mediterranean, and on the surface of the water in various parts of the world. It has a hody several inches in length, thin, and of uniform width, like a piece of rihbon, transparent, and unpigmented. Professor Gill's suggestion was verified by the investigations of Yves Delage in 1886 and Grassi and Calandruccio in 1892 and 1893, who showed that two species of *Leptocephalus* were larvæ respectively of the conger and the common eel. Fuller accounts of the observations of Professors Grassi and Calandruccio have heen puhlished recently in the Proceedings of the Royal Society and the Quarterly Journal of Microscopical Sciences. The specimens investigated were captured, along with deep-sea fishes, in the Strait of Messina, where the currents are strong and beset with whirl-

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pools. Hence it is inferred that the spawning of eels and the development of the eggs and larvæ take place at great depths, and the young are brought to the surface by movements of the water. Professor Grassi believes that the elvers, or eel fare, which ascend rivers are already a year old.

Dr. George M. Dawson has found evidence—consisting chiefly of belts of trees killed by the rise of the water over their roots—that since 1880, or possibly earlier, the water of many small lakes and ponds without outlet throughout the southern part of British Columbia has stood permanently or for prolonged intervals at higher levels than those that prevailed during forty or fifty years previously. This carries back the period of low water to 1840 or 1830. The water appears to be declining now. The lakes lie within the area between the Rocky Mountains and the Coast Ranges. Similar fluctuations have been observed by Mr. G. K. Gilbert in the Great Salt Lake. The phenomena possibly point to some secular change, the nature and causes of which are not known.

The topographic and geologic maps of the United States are, in conformity with an act of Congress, offered for sale. They are prepared from actual surveys, and the topographic maps show all necessary physical and cultural details. Each sheet, sixteen and a half by twenty inches, is designated by the name of some principal town or prominent natural feature within the district, and covers one sixteenth, one fourth, or the whole of a geographical degree, according to the scale on which it is made. The sheets will be sold for five cents each, or, if the orders are for one hundred sheets or over, whether the same or different, for two cents each. The folios of the geologic atlas, containing the topographic, areal, economic, and structural geologic maps, with textual descriptions, will be sold at prices according to the size—usually twenty-five cents. Send postal or express orders, not stamps or checks.

H. Beauregard is authority for the following information in the *Comptes Rendus:* Ambergris is a calculus which is developed in the rectum of the sperm whale. This calculus is composed of crystals of ambrine mixed with considerable black pigment from the rectal lining and star-coral *débris.* When it is fresh it is of a soft consistence and its odor is not at all agreeable; but if preserved for several years away from the air, it loses this disagreeable odor and retains merely a delicate perfume *sui generis,* which gives it great commercial value. This change is due to a microbe for which the author proposes the name *Spirillum recti physeteris.*

Lord Lister and Pasteur many years ago showed that the souring of milk and cream is due to a process of fermentation during which the milk sugar is converted into lactic acid, and that this is due to the activity of minute micro-organisms. It remained for Prof. Wilhelm Storch, of Copenhagen, however, to introduce the use of pure cultures of milk-souring bacteria in butter-making. Storch found that several kinds of acid-producing bacteria are concerned in the normal souring of cream, and he isolated three species that imparted especially fine flavors to butter. Other workers in this subject have been Professor Weigmann, of Kiel, in Germany, and Prof. H. W. Conn, of Wesleyan University. Now S. C. Keith announces in the Chemical News his discovery of a new flavor-producing bacterium which he calls *Micrococcus butyri-aromafaciens.* It is a micrococcus growing at 37° to 20° C. It liquefies gelatin slowly, but does not grow well on potato.

NOTES.

It is very curious and almost paradoxical, says M. V. Brandicourt, reviewing in *La Nature* the underground temperature observations made in excavating the great Alpine tunnels, to find underneath the eternal snows physical conditions like those of tropical regions. Under its frigid envelope of ice the *massif* of the Alps is nearly a hot furnace, and nowhere else in Nature can a more striking contrast between the intense cold of the higher peaks and the heat stored up in the depths of the soil be found. It is computed that tunnel borers under Mont Blanc would meet a temperature of 122° F. in the deepest part of the excavation.

It is suggested in the report of Prof. W. A. Hardman and Mr. Andrew Scott, on disease in the oyster, that the dread of germs may be carried too far. "After all," Professor Hardman says, "we do not want—even if we could get it—an aseptic oyster. The rest of our food—our milk, our bread and cheese, our ham sandwiches, and so on—are teeming

with germs, most of them harmless so far as we know, but some of them may be just as bad as any that can be in shellfish. If we were to insist on breathing filtered air and eating nothing but sterile food, washed down with antiseptic drinks, we should probably die of starvation or something worse, if we did not go mad first with the constant anxiety." The report holds that our object should be to get our oyster beds as healthy as possible, but not to insist upon conditions that would make it impossible to rear any oysters at all.

THE Hon. Carroll D. Wright, United States Commissioner of Labor, has been elected a member of the Institute of France, and an honorary member of the Imperial Academy of Science of Russia.

AT the annual meeting of the Indiana Academy of Science the following officers were elected for the year 1898: President, C. A. Waldo, Purdue University; vice-president, C. H. Eigenmann, Indiana University; secretary, John S. Wright, Indianapolis; assistant secretary, A. J. Bigney, Moore's Hill College; press secretary, George W. Benton, Indianapolis; treasurer, J. T. Scovell, Terre Haute.

A STORY is told in the Electrical Review of London to the effect that Augurelli, in the sixteenth century, believing or pretending to believe that he had discovered the art of making gold, dedicated a treatise which he wrote on the subject to Pope Leo X. The Pope received him with much ceremony and spoke with an appearance of great cordiality, and he flattered himself that he was going to receive a very liberal reward. At the close of the interview Pope Leo took a large purse out of his pocket and presenting it to him said, "As you are able to make gold, I can not offer you a more useful and fitting present than a purse to put it in."

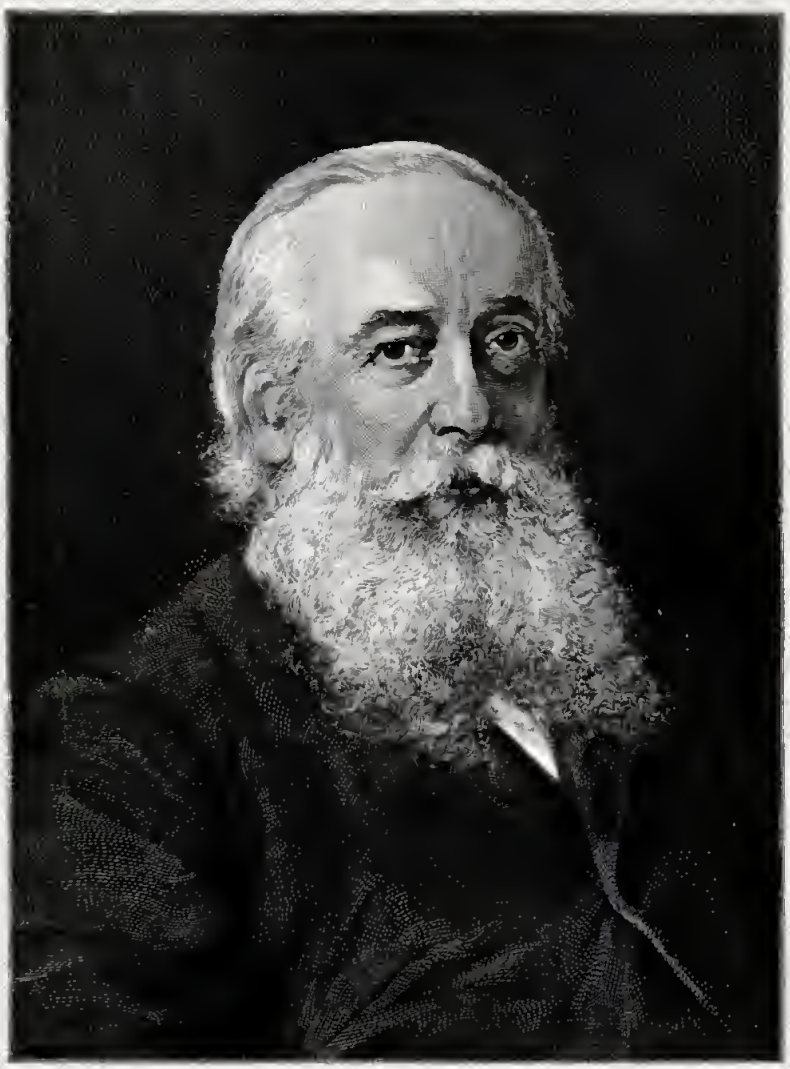
THE people living along the river Tura, in the Russian government of Tomsk, to collect the platinum that abounds in the river sands, hitch a sort of a plowshare to the rear of a raft. This plows up the water, as they express it, and the sands of the bottom are led into a wooden conduit, whence they pass into a tub furnished with pine branches, among which the metal settles by virtue of its high specific gravity. The exploiters are said to find this method of washing profitable.

THE carpet industry at Osaka, Japan, according to the British consul at Hiogo, gives employment to about ten thousand children and youth of both sexes from seven to sixteen years of age. The carpets are made of jute, with designs imitating those of Persia and Turkey. About four thousand eight hundred square yards of goods are produced a day.

THE Philadelphia Mycological Center is a club, of which Captain Charles McIlvaine is president, for the study and testing of mushrooms. Its second Bulletin, for September, 1897, gives descriptions, with the results of testings, of twenty-one species. Most of these species were found to be good eating, but cautions are given respecting a few of them. The "Center" seems to be prospering, for the Bulletin gives the names of fifteen new members in Pennsylvania, New Jersey, New York, and Massachusetts.

THE Hon. Ralph Abercrombie, meteorologist, whose death at Sydney, Australia, June 21st, has been mentioned in the Monthly, was born in 1842, and was always in delicate health. Having entered the British army in 1860, he was stationed at Quebec in 1864, and while there obtained leave of absence and visited General Grant. He was obliged to give up his commission in 1869, and after this the maintenance of his health became a serious care with him. His meteorological studies began at an early period, and his first book—Seas and Skies in Many Latitudes—embodied observations made by him while in the military station at Quebec. His most distinguished service to meteorology was probably the preparation, in conjunction with Professor Hildebrandsson, of Upsala, of the new classification of clouds, which was adopted by the International Meteorological Congress of 1896. He was author of works on the Principles of Forecasting, of the book on Weather in the International Scientific Series, and of many contributions to scientific societies. During his seven years of illness at Sydney he made grants of money for the production of essays on meteorological subjects, three of which have been published.

THE record of recent deaths among men of science includes the names of Arthur Kammermann, attached to the observatory at Geneva since 1881, in his thirty-sixth year; Ernest Giles, Australian explorer; Thomas Jeffrey Parker, professor of biology in the University of Otago, and author of works on biology, at Dunedin, New Zealand, November 7th; Prof. Francesco Brioschi, mathematician and president of the Accademia dei Lincei in Milan, December 13th, aged seventy-two years; James Holm, professor of physics in the South African College, Capetown, aged twenty-eight years; Dr. Oscar Stumpe, astronomer, at Berlin, aged thirty-five years; Dr. Eduard Lindemann, scientific secretary of the Observatory of Pulkova, Russia, in his fifty-sixth year; Prof. E. L. Taschenburg, author of contributions to Economic Entomology, January 20th, aged seventy-nine years; M. Ernst Bazin, inventor of the roller steamer; and Dr. Samuel Newth, formerly principal of New College, St. John's Wood, England, and author of books on natural philosophy.



CARL SEMPER.